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ANNUAL REPORT 1962

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1962 *Annual Report*

THE SECRETARY OF THE INTERIOR

Stewart L. Udall



For the Fiscal Year Ended

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THE SECRETARY OF THE INTERIOR
WASHINGTON

DEAR MR. PRESIDENT: Transmitted herewith is the 1962 annual report of the Department of the Interior.

In your conservation message to the Congress in March 1962 and again at the White House Conference on Conservation you emphasized that the continued availability of our life-sustaining natural resources must depend on our using them prudently, improving them wisely, and where possible, restoring them promptly.

Since January 1961 this Department has been instrumental in the accomplishment of milestone conservation gains. These standout gains, advanced by a farsighted Congress, are the first chapters in meeting this Administration's goal of providing a conservation record in the 1960's worthy of the two Roosevelts.

Reflected in this summary of Departmental activities are the significant results now being achieved in the protection and development of our priceless resources of land and water through programs for which the groundwork was laid with the beginning of this Administration.

We can now indeed see new horizons in conservation progress which in the years to come will help to assure our continued security and progress as a nation.

Sincerely yours,

Secretary of the Interior.

THE PRESIDENT,
The White House.

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Part I

New Horizons in Resource Conservation

New Horizons in Resource Conservation

Three times in this century—at intervals spaced some 30 years apart—America has faced a grave threat to the abundance and adequacy of its natural resources—and consequently to the future of the Nation itself.

On each occasion, the necessary strong hand of leadership has been found to meet the threat through bold conservation actions—and we have forged ahead into new eras of progress.

The conservation movement had its beginnings in the early 1900's after we as a people had waged a ruthless "hundred years' war" on the resources of this continent in the mistaken belief that nature's bounty knew no limits. Only a few men—John Wesley Powell, Carl Schurz, John Muir and a handful more—recognized the danger signals in the burned forests, the silt-choked streams and disappearing wildlife, but they found a ready champion in the young President who had just taken office—Theodore Roosevelt.

TR—the first great conservationist President—gathered about him such lieutenants as Gifford Pinchot and moved swiftly to put an end to the squandering of our national birthright. He provided our forests and water resources with systematic programs of protection, renewal and development and took action to reserve for all of the people much of the remaining land suitable for forests, parks, and refuges for wildlife.

It was largely on the momentum of this work that we moved forward in the conservation of natural resources until the 1930's when the Great Depression and the Dust Bowl served unmistakable notice

that we were headed again toward resource bankruptcy unless we took further action—and promptly—to repair the damage of the past.

Again—fortunately for America—there was leadership equal to the task. Among the principal programs of Franklin D. Roosevelt's first term were conservation programs that constituted a massive effort to rescue and reclaim and develop our fundamental resource base of land and water.

Through such action programs as the TVA, the Civilian Conservation Corps, the Rural Electrification Administration, and many others, the threat was averted and a foundation built for future progress in essential natural resource programs.

Today we face a new crisis affecting the whole broad field of our natural resources—a crisis which, though perhaps not so dramatically apparent to all as that of the 1930's is nonetheless as real and dangerous.

The conservation crisis of the 1960's has resulted neither from ignorance nor folly, but from our very success as a Nation—the rush of progress symbolized by our burgeoning cities and thriving industry, and hastened greatly by expanding population.

President Warns of Resource Challenge

The proportions of the developing emergency were clearly seen by President Kennedy when he took office in January 1961. Only weeks later, in a special message to the Congress on natural resources, he spelled them out in these terms:

“In the resource field, predictions of future use have been consistently understated. But even under conservative projections, we face a future of critical shortages and handicaps. By the year 2000, a United States population of 300 million—nearly doubled in 40 years—will need far greater supplies of farm products, timber, water, minerals, fuels, energy, and opportunities for outdoor recreation. Present projections tell us that our water use will double in the next 20 years; that we are harvesting our supply of high-grade timber more rapidly than the development of new growth; that too much of our fertile topsoil is being washed away; that our minerals are being exhausted at increasing rates; and that the Nation's remaining undeveloped areas of great natural beauty are being rapidly preempted for other uses.”

The President's message made plain his conviction that a new conservation effort of Rooseveltian proportions was urgently required to assure an adequate resource base for the future, both immediate and distant.



While the first major additions to our outdoor recreational areas in 16 years bring new opportunity to millions of Americans, there still remain significant areas, such as the proposed Canyonlands National Park, which should be preserved for posterity.

Symbolic of the seriousness with which he views the problem was his call for a White House Conference on Conservation to be held in Washington—the first since the days of Theodore Roosevelt.

White House Conference on Conservation

Convened in May 1962, the Conference served to pool the talents of 500 leading conservationists from throughout the Nation in a major new conservation enterprise designed to:

- Exploit science to “create” new resources and enlarge the use of existing resources;
- Give new vigor to traditional programs;
- Increase our vigilance against unnecessary resource waste;
- Unlock the resources of the sea;
- Reserve for their highest human uses the remnants of the American wilderness;
- Establish a land conservation fund to ensure the acquisition of key conservation and outdoor recreation lands;
- Wage an all-out attack on water and air pollution;
- Help cities save open space and plan their growth;



Established on August 7, 1961, Cape Cod, Mass., became the first seashore area authorized since the 1930's.

- Grow adequate timber supplies for future needs;
- Save the remaining shorelines for public use;
- Learn to husband fresh water, and to extract it economically from the sea;
- Plan now the water development of all river basins;
- Preserve a viable habitat for waterfowl and wildlife;
- Mount a vigorous campaign—with greatly strengthened State and local participation—to enlarge the opportunities for outdoor recreation;
- Earmark military reservation lands as an ultimate conservation reserve for Federal, State and local governments;
- Establish a Youth Conservation Corps to work in the vineyard on most of these problems; and above all,
- Share our conservation know-how and conservation ethic with men everywhere.

Actually, the White House Conference reaffirmed, rather than enunciated, the goals of the Kennedy Administration's aggressive new approach to the Nation's conservation problems.

The President's clear intention of bending every effort toward achievement of the greatest era, in the conservation history of the

United States had been made evident from the beginning of his term when he wrote in his special message to the Congress:

"From the beginning of civilization, every nation's basic wealth and progress has stemmed in large measure from its natural resources. This Nation has been, and is now, especially fortunate in the blessings we have inherited. Our entire society rests upon—and is dependent upon—our water, our land, our forests, and our minerals. . . . Wise investment in a resource program today will return vast dividends tomorrow, and failures to act now may be opportunities lost forever. Our country has been generous with us in this regard—and we cannot now ignore her needs for future development."

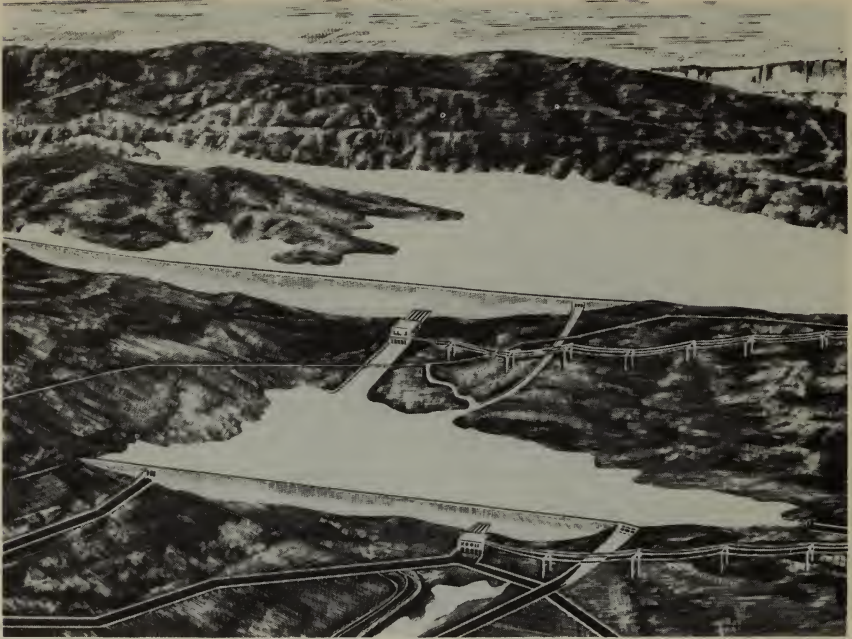
Acting under the spur of this leadership, the people of the United States—both through the Congress and in independent State and local actions—have joined together in increasing numbers to make possible an unprecedented advance in conservation progress, particularly in the vital area of water resource use and development, and in decisions to preserve, while there is yet time, as much as possible of the outdoor heritage which traditionally has played a deeply significant role in shaping our character and destiny as a Nation.

Water Resources

In any consideration of future resource needs, we are confronted with one basic and sobering fact: assurance of an adequate supply of usable water is rapidly becoming one of the most pressing problems not only in the United States but throughout the world.

Recognition of this fact was clearly emphasized in the President's first special message to the Congress on conservation in 1961; and it was restated in even plainer words in his second resource message this year in which he said:

"Our Nation's progress is reflected in the history of our great river systems. The water that courses through our rivers and streams holds the key to full national development. Uncontrolled, it wipes out homes, lives and dreams, bringing disaster in the form of floods; controlled, it is an effective artery of transportation, a boon to industrial development, a source of beauty and recreation, and the means of turning arid areas into rich and versatile cropland. In no resource field are conservation principles more applicable. By 1980, it is estimated, our national water needs will nearly double—by the end of the century they will triple. But the quantity of water which nature supplies will remain almost constant.



The Department and the State of California are jointly constructing the \$515 million San Luis unit of the Central Valley project, northwest of Fresno, Calif. Under the agreement, California will meet 55 percent of the construction cost of the joint facilities, shown here.

"Our goal, therefore, is to have sufficient water sufficiently clean in the right place at the right time to serve the range of human and industrial needs . . .

"This Administration adheres to the policy enunciated in my natural resources message of last year that our available water supply will be used to provide maximum benefits for all purposes—hydroelectric power, irrigation and reclamation, navigation, recreation and wildlife, and municipal and industrial water supply. These diverse uses and our future needs require thoughtful preservation and full development of our national water resources."

Water Development Programs Reach New Peak

The response to this admonition—and to the President's simultaneous reminder that the lead time is long in the development of water resources—became clearly apparent when:

1. The second session of the 87th Congress authorized the \$171 million Fryingpan-Arkansas project in Colorado and the \$220 million

San Juan-Chama and Navajo Indian irrigation projects in Colorado and New Mexico—the first time in the 60-year history of the Department's Bureau of Reclamation that Congress has approved two water resource projects of this magnitude in a single year.

2. The Reclamation program reached its highest level in history with total expenditures of \$347 million for all activities in fiscal year 1962.

3. Congressional approval was given to Federal participation in the Delaware River Basin development program on a partnership basis with the States of Delaware, New Jersey, New York, and Pennsylvania.

4. Congress approved legislation establishing a Federal-State-local water pollution attack capability that comes closer to meeting our national needs than any we have had before, and,

5. Congressional authorization of a \$75 million expenditure through fiscal years 1962–1967 made possible a considerably accelerated research and development program by the Department's Office of Saline Water.

These actions represent only the major developments in two years of rapid progress in water resource conservation.

"We cannot delude ourselves," President Kennedy told the Congress in 1961. "We must understand our resources problems and face up to them."

It required little time to indicate that we, as a people, were prepared to follow this advice.

Fryingpan-Arkansas Project

One of the clearest evidences of the new progressive viewpoint came with approval of Fryingpan-Arkansas, a Reclamation project which, prior to 1962, had been advocated by conservationists for more than 30 years. Designed to divert surplus water from the western slope of the Rocky Mountains to the water-deficient eastern slope, the project, through use of a transmountain tunnel, will help irrigate the Arkansas River Basin and give drinking water and electricity to an area covering more than half the State of Colorado.

More specifically, it contemplates construction of storage and water carriage works to provide supplemental irrigation water for 280,000 acres of presently irrigated land in the Arkansas River Valley in Colorado; it will supply water to meet expanding needs for municipal, domestic, and industrial water on both sides of the Continental Divide, reduce flood damage along the Arkansas River east of Pueblo, generate annually about 500 million kilowatt-hours of hydroelectric power, and make significant contributions to recreation and to the conservation and development of fish and wildlife. Of the \$171 million cost of the



President Kennedy receives applause during his address at Pueblo, Colo., in August 1962 at ceremonies commemorating the authorization of the \$171 million Fryingpan-Arkansas reclamation project in Colorado.

project, a total of \$151 million will be repaid by users, most of it with interest.

"This is an investment in the future of this country," President Kennedy said, "an investment that will repay large dividends. Its water impounded at over 9,000 feet will drop through an unprecedented seven powerplants to produce electricity for homes and factories and farms, and there will be new water for new people and new industries. Fryingpan-Arkansas is an excellent example of full development of our water resources to provide maximum benefits for all of our people."

San Juan-Chama and Navajo Indian Irrigation Projects

Of similar significance was legislation authorizing the initial stage of the San Juan-Chama project and the Navajo Indian irrigation project as participating units of the Colorado River storage project.

The initial stage of the San Juan-Chama project in Colorado and New Mexico will provide urgently needed additional water for lands in areas tributary to the Rio Grande that have been centers of economic distress. It will supplement the water supply of the highly important Middle Rio Grande project, and it will provide additional water for the rapidly growing requirements of the city of Albuquerque and defense establishments of the Rio Grande Basin in New Mexico.

The Navajo Indian irrigation project provides for construction of distribution facilities to deliver water from the Navajo Reservoir, presently under construction by the Bureau of Reclamation on the San Juan River, some 150 miles across reservation lands in northwestern New Mexico to irrigate more than 110,000 acres of land.

This important project will provide economic assistance to the hard-pressed Navajo Indians and will enable New Mexico to put to use a major portion of the water of the Upper Colorado River system to which it is entitled under two interstate compacts.

San Luis Unit of Central Valley Project

Another high point in Reclamation action came late in 1961 when the Department approved an agreement with the State of California for Federal construction of the \$515 million Federal-State San Luis unit of the Central Valley project, northwest of Fresno, Calif. Under the agreement, California will meet 55 percent of the construction cost of the joint facilities, representing a vital link in the State's long-range program to speed economic development through the diversion of surplus water from the north to arid southern California. A measure of the scope of the project is shown in the fact that the Federal Government will serve some 500,000 acres of farmland in the San Joaquin Valley with irrigation water from its portion of the unit. The Federal contribution to cost of the project will be \$277 million—of which 99.9 percent will be repaid by water users.

Trinity Dam Completed

In January 1962 the world's highest earthfill dam—Trinity—was completed 2 months ahead of schedule. Symbolizing the giant strides in long-term Reclamation progress, the 537-foot-high dam is a major feature of the \$251 million Trinity River division of the Central Valley project which also includes two major tunnels that will carry water through the mountains from Trinity River to the Sacramento River Basin; Whiskeytown Dam; and three major powerplants. The Division is scheduled to be completed by mid-1964.

Trinity Reservoir, which began filling in 1961, will store 2½ million acre-feet of water, exceeded in California only by Shasta Lake above Shasta Dam on the Sacramento River. The Trinity River division will increase by nearly 1½ million acre-feet the irrigation water available to the Central Valley project on which some half-million acres are now receiving water from Reclamation-constructed works.

The division's three major powerplants at Trinity Dam, Clear Creek, and Spring Creek are scheduled to go into operation in 1963, producing some 1¼ billion kilowatt-hours of energy annually.



Trinity—world's highest earthfill dam—symbolizes the giant strides in long-term Reclamation progress. A major feature of the \$251 million Trinity River division of California's Central Valley project, dam was completed in January 1962, 2 months ahead of schedule.

Trinity Dam's reservoir—covering 16,400 acres with a scenic 145-mile shoreline in heavily timbered mountains—provides California with an important recreation area. At the same time, the Trinity River works, including a fish hatchery below Lewiston Dam, will help maintain river sports fishing as well as benefit Pacific coast commercial salmon fishing.

CONSTRUCTION COMPLETED

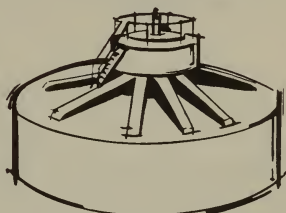
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178,000
ACRE FEET

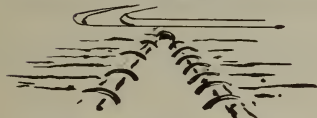
RESERVOIRS

95,000 K.W.

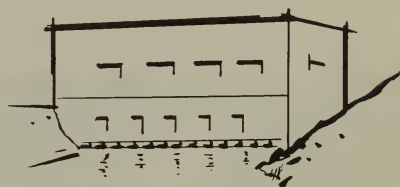


HYDROELECTRIC
GENERATING CAPACITY

335 MILES



PIPELINES, CANALS
LATERALS, DRAINS



15 PUMPING PLANTS



475 MILES

TRANSMISSION LINES

\$300 Million in Reclamation Contracts

In total, during the 18 months beginning in January 1961, the Bureau of Reclamation advanced its water resource development programs in the 17 Western States by awarding more than 2,000 contracts at a cost of over \$300 million. Included were contracts for 13 storage dams in 10 States which when completed will provide a total reservoir capacity of 5 million acre-feet of water for irrigation,

hydroelectric power, municipal and industrial water supplies, recreation, fish and wildlife, and other beneficial purposes.

While this great program is being carried on in the West, its impact on the total national economy is by no means confined to that area. The availability of irrigation water converts the risks of dryland farming to a consistently less hazardous and more profitable farm operation. The provision of vast new sources of hydroelectric power stimulates industrial development, modernization of rural life, and urban development. The wealth thus produced devotes itself to the national interest through increased buying power and an expanded tax base.

In the words of President Kennedy, "Nothing could be more disastrous for this country than for people from the East to say, 'There is no benefit to us in spending our money to make this valley green.' That is the way to stand still. As one State does well, so do the others—and if one State stands still, so do all the rest."

At the same time, there is no basis for apprehension that continuing irrigation development brings more lands into agricultural production and hence intensifies the agricultural crop surplus problem. A dominant feature of irrigation farming is diversification. The chief



Developing the water resources of the West, the Department of the Interior adds to the nutritious diet of the Nation without increasing production of surplus feeds and grains. The bulk of the Nation's fresh vegetables and fruits are provided through irrigation.

products of irrigation are nutritious fruits and vegetables and meats which are not in surplus and which help sustain the health and economy of the Nation. The scope of Reclamation's contribution in this regard may be seen in the latest annual crop reports which show that the 1961 harvest on farms irrigated by Reclamation projects exceeded the billion-dollar mark for the third successive year.

While pressing ahead with visible progress in steel and concrete, the Bureau of Reclamation since January 1961 has considerably accelerated programs of equal long-range significance in research designed to conserve existing water supplies and to develop new ways of meeting our future water needs.

Weather Modification Research

An example is a program of weather-modification research which the Bureau has undertaken in cooperation with the National Science Foundation and the U.S. Weather Bureau. Contracts have been awarded to three universities for research in support of the program, the long-range objective of which is to increase water supply in Reclamation projects through artificially induced precipitation.

Meanwhile, stepped-up field tests have resulted in encouraging advances in programs to develop practical techniques to reduce the current annual loss through evaporation of millions of acre-feet of water from storage reservoirs, and to develop effective low-cost linings to cut similar costly losses through seepage from irrigation canals.

River Basin Development

The urgent need for action to solve our growing national water resource problems has perhaps never been more clearly pointed up than in the findings of an intensive 2-year study by the Senate Select Committee on National Water Resources completed at about the time President Kennedy began his term of office.

The committee's supply-demand investigation—in which the Department of the Interior and other agencies participated—showed:

1. That full development of all available resources in five regions of the West will be required by 1980 or earlier if the needs of that area's growing population are to be met and the projected expansion of economic activity achieved; and,
2. That by the year 2000, three other regions—including one east of the Mississippi—will be added to the list if water supplies are to meet demands.

In response to this and other danger signals, the President forwarded to the Congress a blueprint for the comprehensive, progressive

machinery so long needed if we are to be serious in our efforts to assure adequate water for present and future needs. His proposed Water Resources Planning Act would:

- Establish a Cabinet-level Water Resources Council to be the keystone in a comprehensive structure for water resource planning within river basins and would provide overall guidance and standards for planning, consistent with existing law;

- Authorize the President to create—at the request of the Governor of one or more affected States, or of the Council—a river basin water resources commission for any region, major river basin, or group of related river basins in the United States. These commissions, composed of representatives of the States and Federal agencies concerned, would be charged with preparing and keeping up to date integrated plans for Federal, State, and local development of water and related land resources, and,

- Provide encouragement to the States to participate fully and effectively in water and related land resource planning through a system of Federal financial assistance.

The act would require that any river basin plan take into account domestic, agricultural, energy, industrial, recreational, fish and wildlife, and other major resource conservation and development. It would enable the Congress—within the Federal sphere of responsibility—to decide upon the many individual project developments on the basis of full information as to the overall needs and timing for basin development. At the same time, States and local interests—within their respective spheres of responsibility—would be enabled to do likewise.

Delaware River Basin Project

With action on this far-reaching measure pending in the Congress, the Federal Government moved on another front to save valuable time in the race against the day when water of acceptable quality will not meet the needs of a large part of the United States.

With congressional approval, agreement was reached for Federal participation in the unique organizational experiment in multiple-purpose water resource management currently underway in the Delaware River basin.

The instrument for this management and development is the Delaware River Basin Commission, representing the first effort to create a form of Federal-Interstate Compact organization empowered to represent both the Federal Government and the States of Delaware, New Jersey, New York, and Pennsylvania in planning, programing, scheduling, financing, and executing a water resource program of

vital economic importance to 21 million people in this major eastern watershed.

Today, rapid and encouraging progress is being made toward launching of a development program involving a potential billion-dollar investment in flood control, outdoor recreation facilities, soil conservation projects, water pollution control works, fish and wildlife management facilities, pumped storage power facilities, municipal water supply works, river regulation, and diversions of navigation facilities.

Saline Water Conversion

In his special conservation message to the Congress in February 1961, President Kennedy declared: "No water resources program is of greater long-range importance—for relief not only of our shortages, but for arid nations the world over—than our efforts to find an effective and economical way to convert water from the world's greatest, cheapest natural resources—our oceans—into water fit for consumption in the home and by industry . . . This Administration is currently engaged in redoubled efforts to select the most promising approaches to economic desalinization of ocean and brackish waters, and then focus our energies more intensively on those approaches . . . I urge the Congress to extend the current saline water conversion research program, and to increase the funds for its continuation."

Congressional response to this appeal was prompt. Today, with a \$75 million program authorized through fiscal year 1967, saline water research and development activities are moving forward at a notably quickened pace. The past 2 years have seen these highlights of progress:

- Demonstration plants are in operation at Freeport, Tex., Webster, S. Dak., and San Diego, Calif.—with millions of gallons of converted fresh water flowing daily to consumers.

- A million-gallon-a-day demonstration plant is under construction at Roswell, N. Mex., and is scheduled to go into operation in 1963.

- Negotiations are underway for construction of a large freezing process pilot plant at Wrightsville Beach, N.C., to fully exploit, as rapidly as possible, this promising desalination method.

- Research and development contract awards by the Department's Office of Saline Water increased from \$1.2 million for the first half of fiscal 1962 to \$5.6 million in the second half.

- In March 1962, the Office of Saline Water transferred \$365,000 to the Atomic Energy Commission for participation by the Commission's Oak Ridge National Laboratory in basic research phases of the saline water conversion program. Thus,



New Point Loma sea-water desalting plant near San Diego, Calif., points out multiple piping systems through which the flash evaporator process functions.

for the first time, the skills and capabilities of the personnel at the Oak Ridge laboratories were brought to bear on problems other than those of an atomic nature. The agreement with AEC marked the largest single expenditure for basic research by the Office of Saline Water in its 10-year history which has seen the cost of conversion reduced from about \$5 per thousand gallons to a minimum of about \$1.

During the year, the benefits of saline water conversion were dramatically demonstrated in the Virgin Islands, one of the territories administered by the Department. A saline water plant operated by the Virgin Islands Corporation was successful beyond expectations. Drinking water formerly had to be brought into the territory by barge, at a cost of more than \$3 per thousand gallons. The saline water plant was expected to produce about 250,000 gallons daily for approximately \$1.75 per thousand. But since February of this year it has been producing about 300,000 gallons daily for \$1.63 per thousand.

President Kennedy's continuing deep personal interest in the ultimate success of our saline water efforts perhaps was most clearly indicated in his address to the White House Conference on Conservation in May 1962. In his remarks, the President said, "Our great contribution in the 1950's and 1960's, it seems to me, is applying the great discoveries of science to this question of conservation, how to get fresh water from salt water at competitive terms, a matter which can mean such an extraordinary amount to people of the West, the Southwest, and really in a sense to people all around the globe. I have felt that whatever country can do this in a competitive way will get a good deal more lasting benefit than those countries that may be even first in space."

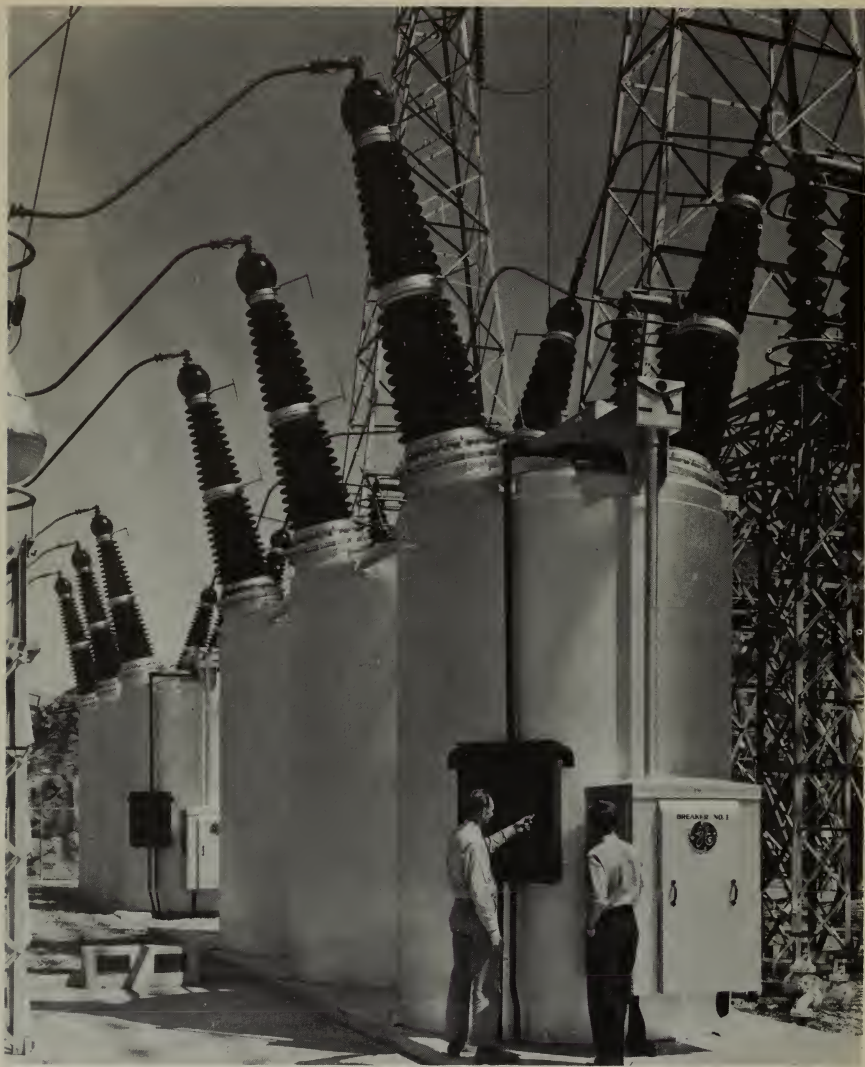
New Water Resource Evaluation Standards

In another significant water conservation action, the Secretaries of Health, Education, and Welfare, Agriculture, Interior, and of the Army, acting as a Water Resources Council, developed an up-to-date set of uniform standards to facilitate national progress in the formulation and evaluation of water resources projects. In May 1962, the President approved these new policies, standards, and procedures for application by the four departments and the Bureau of the Budget. Implementation of these standards means that for the first time full comprehensive treatment of all water and related land uses, including alternative uses, are to be given consideration in the planning and evaluation of water projects.

Electric Power

One of the major challenges in resource conservation lies in the orderly development and efficient utilization of energy resources to meet the Nation's electric power needs—needs which double every decade.

To meet the challenge, this Administration has moved forward more rapidly in electric power development—including significant



Modern equipment such as this helps to provide the needs of our Western States for electric power. This is one of the many functions of Reclamation programs.

innovations until recently considered impractical or impossible—than any other in many years.

“Our goal,” President Kennedy has said, “is to ensure an abundance of low-cost power for all consumers—urban and rural, industrial and domestic. To achieve this, we must use more effectively all sources of fuel, find cheaper ways to harness nuclear energy, develop our hydroelectric potential, utilize presently unused heat produced by

nature or as a byproduct of industrial processes, and even capture the energy of the tides where feasible.”

Cooperative Power Pooling

As a first step in this approach, the President directed the Department to develop plans for the early interconnection of areas served by its hydroelectric power marketing agencies with adequate common carrier transmission lines; to plan for further national cooperative pooling of electric power, both public and private; and to enlarge such pooling as was then in existence.

The first result came soon afterward when the Department's Bonneville Power Administration, the U.S. Army Corps of Engineers, and nine private and public owners of hydroelectric generating facilities signed a coordination agreement designed to produce maximum power at powerplants on Pacific Northwest rivers.

The agreement provided that storage and generating facilities would be operated in much the same manner as if all were under one ownership; it also provided for interchanges of energy and power among the signers in order to conserve water in reservoirs, and for coordination of the transmission facilities of the parties to the agreement.

This pioneering agreement, involving 65 hydroelectric plants and 13 steam plants with total installed capacity of 11.8 million kilowatts, produces an extra million or more kilowatts of firm power that would be wasted if each utility operated its hydroplants independently.

A major breakthrough toward achieving the Administration's goal of more plentiful low-cost power through the pooling of public and private facilities came after Congress, in 1961, approved construction on an all-Federal basis of the backbone transmission lines required to market the power generated by the giant five-State Colorado River storage project.

“Competitive Cooperation” Launched

Early in 1962, the Department announced the far-reaching decision that some of the transmission lines for the Colorado River project would be built by private utilities—and thus a new era of “competitive cooperation” between public and private utilities was brought into being.

Among other significant benefits, the Colorado River decision will reduce the investment in Federal facilities by \$27 million; make for more reliable delivery of Federal hydropower to preference customers at lower costs and, in turn, make the private company systems more reliable. Additionally, it will add \$77 million to the project's basin fund by the year 2042, when the 87-year payout period is completed.

Contracts have been signed between the Department and private utilities serving Utah, New Mexico, Colorado, and Wyoming for transmission of CRSP power over an interconnecting system of Federal and private power lines. A total of about 1.2 million kilowatts will be generated at the authorized hydroelectric plants of the storage project.

Other Pooling Agreements

With public-private pooling arrangements spreading rapidly to other areas, these have been among developments of 1962:

— Contracts have been signed between the Government and Missouri cooperatives which will assure a steady flow of electric power to more than one million customers in that State through the pooling of generating and transmission facilities of the Federal Government, rural electric cooperatives, and private utilities.

— The Department has accepted a proposal by the Basin Electric Power Cooperative Association of North Dakota to enter contract pooling arrangements with the Bureau of Reclamation, thereby making possible the establishment of a large generating plant in the lignite coalfields of North Dakota. This action should assure the development of North Dakota's vast lignite resources and could provide the low-cost power needed for the economic development of the entire upper Missouri River Basin region. Similar action in Colorado will provide economic stimulus to that State's coal industry.

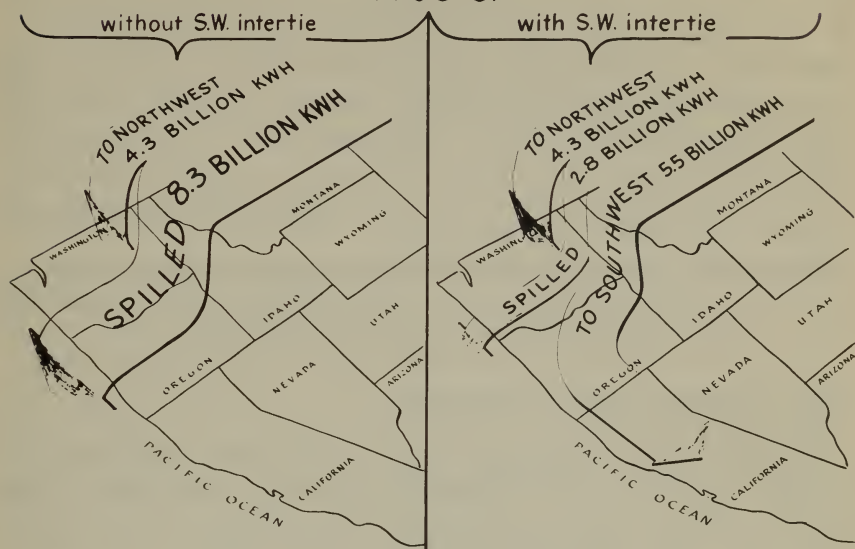
Extra-High-Voltage Direct-Current Transmission

Today in the United States, and throughout the world, we are at a "new frontier" in electricity. Giant new generators are being built with a capacity of a million or more kilowatts, one of which alone can produce enough power to supply a city the size of Washington, D.C.

In a relatively short period of time this means the possibility of transmitting: Yukon River power to Seattle and, by displacement, to Los Angeles; mine-mouth power from West Virginia coalfields to New York and Boston, and from Dakota lignite beds to Chicago and Detroit; power flowing east and west to take advantage of time diversity; power flowing north and south for seasonal diversity; the integration of hydro and steam systems; and, most important, cheaper electricity for all consumers.

Early this year a departmental task force appointed in 1961 to study an extra-high-voltage common carrier interconnection between the Pacific Northwest and Pacific Southwest completed its investigations. In a report widely recognized as a technological landmark, the

DISPOSITION OF SECONDARY ENERGY 1966-67



electric power experts composing the task force found extra-high-voltage direct current transmission not only feasible but, from the engineering standpoint, immediately practicable for these—and other—regions, with the promise of highly important economic benefits.

As a result of this investigation, studies of four high-voltage interties between the Pacific Northwest and other regions are presently in various stages of development. The first of these, the Pacific Northwest-Pacific Southwest extra-high-voltage intertie to provide for an interchange of electric power between the predominantly fuel-fired electric generating plants in the Pacific Southwest and the predominantly hydroelectric generating plants of the Pacific Northwest, is awaiting passage of preference legislation guaranteeing reciprocal regional preference to electric energy generated at Federal plants to consumers in both the Pacific Northwest and regions interconnected with the Pacific Northwest. This intertie would reduce the amount of peaking capacity needed in the Pacific Northwest and Pacific Southwest as well as conserve the energy obtainable from water that would otherwise be spilled by Pacific Northwest hydroelectric plants during the summer months when Pacific Southwest loads hit their peak. In addition, the use of Pacific Northwest hydroelectric power conserves supplies of coal, oil, and gas in the Pacific Southwest.

The second intertie is to provide a connection between the West Kootenay Power & Light Co. in British Columbia and the Bonneville grid at the Canadian border. This regional intertie line is scheduled to be energized in July of 1964, with construction beginning this year. By use of this intertie, the West Kootenay Light & Power Co. can store water in their Kootenay Lake reservoir during August and the first part of September by supplying part of its system loads with energy from Bonneville Power Administration. A like amount of energy will be returned starting at about the middle of September. Benefit to the Federal power system from these operations is estimated at some 53,000 kilowatts of firm power.

Meanwhile, studies of a third and fourth high-voltage intertie—between the Missouri Basin and southern Idaho and the Bonneville Power Administration system—are nearing completion.

High Voltage Tests Accelerated

Work is being accelerated by the Bonneville Power Administration on tests relating to high-voltage direct current transmission. Significantly different from any tests previously undertaken in the United States, they will, in fact, provide data not yet available either here or in Europe. While direct current transmission is used in Europe, notably in Sweden, most of it is under ground or under water. The Bonneville tests will be performed on insulators and conductors strung on towers in a manner similar to alternating current transmission lines. Marking the start of intensive research in this new technique, the Allis Chalmers Manufacturing Co. of Milwaukee has been awarded a \$689,000 contract to build components necessary to convert regular alternating current from the Dalles Dam, on the Columbia River between Oregon and Washington, into direct current and at voltage to extremes not yet approached in this country.

Atomic Power

Approval was given at the close of the 2nd session of the 87th Congress to construction of the world's largest atomic powerplant at Hanford, Wash., to utilize steam from the Atomic Energy Commission's new production reactor.

As a result of the action—representing a significant example of the use of an important resource which would otherwise be wasted—the Washington State public power supply system will build and operate 800,000-kilowatt generating facilities at Hanford and deliver the output to local publicly and privately owned utilities which, in turn, will exchange it with the Bonneville Power Administration for a block of firm power on a nonprofit basis.

The Hanford Act assures Pacific Northwest industries, farmers, and other consumers of a new firm power supply equal to that produced by a major dam and considerably reduces the threat of a previously anticipated regional power shortage within the next few years.

Until passage of the act, Bonneville since 1960 had been unable to offer substantial amounts of firm power to prospective industries. Ultimate employment of up to 50,000 workers now is possible in new industries expected to be attracted by the additional source of inexpensive energy.

Pumped-Back Storage

Congressional authorization of a \$150,000 appropriation has enabled the Department to make significant progress in its studies of the potentials of pumped-back storage projects at Federal reservoirs.

Representing another "new frontier" in the field of power production and marketing, the plan uses cheap off-peak energy to pump water to high elevations for later release to generate hydroelectricity at hours of peak consumption, thus permitting important savings in plant investment for generating capacity.

Parks and Recreation

The far-reaching report of the Outdoor Recreation Resources Review Commission, following two years of intensive study of America's outdoor needs, contained these significant paragraphs:

"Through their prodigious purchases of sporting equipment, hunting and fishing licenses, and other recreational goods the American people have demonstrated an intense (and verifiable) desire to participate in outdoor recreation. Through their expressions of preferences at the ballot box, through repeated and increasing appropriations for recreational development of Federal resources, and through many, and rapidly growing, recreational visits to federally managed resources, the American people have expressed an intense (and verifiable) desire to use such resources for outdoor recreation.

"Outdoor recreation also has cultural values that are essential to the health of the Nation. It is a part of the educational process that strengthens men's minds as well as their bodies; that broadens their understanding of the laws of nature; that sharpens their appreciation of its manifold beauties; and that fortifies man's most precious possession—the spirit which gives life its meaning. These are the qualities which in the long run make a nation and its people truly great and which find strong nourishment in outdoor recreation."

In an atmosphere of growing awareness of these basic facts, substantial progress has been made since January 1961 in providing for America's present and future outdoor recreation needs.

President Kennedy told the 1962 White House Conference on Conservation: "I can think of no more suitable effort for an administration which is concerned with progress than to be identified with efforts to preserve this land and maintain its beauty."

Highlights of Progress

The President's consistent support of programs to provide adequate recreational facilities to meet our growing needs has been a major factor in an outstanding 2-year record of accomplishments of which the following are highlights:

— Cape Cod in Massachusetts, Point Reyes in California, and Padre Island in Texas have been authorized as new National Seashore Areas as part of a comprehensive program to provide outdoor recreation areas adjacent to metropolitan centers.

— The National Park System was further improved with establishment of Haleakala National Park in Hawaii; City of Refuge National Historic Site, also in Hawaii; Buck Island Reef National Memorial near St. Croix, V.I.; Arkansas Post National



Another addition to the outdoor areas reserved for public use in the past year is this new national seashore at Point Reyes, just 30 miles from San Francisco.



This is Padre Island, Tex., an unspoiled shoreline area added to the National Park System in a comprehensive program to provide outdoor recreation facilities near crowded metropolitan centers.

Memorial in Arkansas; Russell Cave National Monument in Alabama; St. Thomas National Historic Site in the Virgin Islands; and Theodore Roosevelt Birthplace and Sagamore Hill National Historic Sites in New York.

— Enactment of the Housing Act of 1961, a landmark in conservation effort, now enables urban areas to guide their growth and development through the acquisition of public lands in tracts up to 5,000 acres for recreation and other purposes.

— To provide additional recreational resources, the Department has inaugurated an intensive program for expanded recreational use of public lands. A major feature of the program is the sale to State and local governments of public lands expressly for outdoor recreation at the nominal fee of \$2.50 per acre.

— Under revised regulations affecting the construction of federally financed reservoirs, sufficient land can now be acquired to preserve the recreational potential of large water impoundments.

New Federal Recreation Agency

— A Bureau of Outdoor Recreation has been established in the Department to coordinate Federal recreation programs; stimulate and provide assistance to the States in the development of recreation programs; sponsor and conduct research; encourage interstate and regional cooperative recreation projects; conduct recreation resource surveys; and formulate a national recreation plan on the basis of State, regional, and Federal plans.

— The President, by Executive order, established a Cabinet-level Recreation Advisory Council—consisting of the Secretaries of the Interior, Agriculture, Defense, Health, Education, and Welfare, and the Administrator of the Housing and Home Finance Agency—to facilitate coordinated efforts among the various Federal agencies concerned with outdoor recreation.

— Preliminary hearings have paved the way for congressional action on the President's request for establishment of a "pay-as-you-go" land conservation fund to finance acquisition of lands for conservation and recreation purposes. The fund would be



Elk hunting is tops on the Fort Apache Indian Reservation. Development of recreational resources on Indian reservations is being pressed vigorously by many tribal groups.

supported by recreation taxes and user charges to apply originally against an advance appropriation of \$500 million.

— Congress authorized use for recreation of facilities at wildlife refuges and fish hatcheries provided it does not interfere with primary conservation objectives. Under this legislation, the Department of the Interior will install recreational facilities, including picnic areas, swimming beaches, and boat docks, at some 200 federally operated hatcheries and refuges.

— A special recreation inventory, scheduled for completion early in 1963, is being conducted by the Department's Bureau of Land Management to identify areas of the national land reserve suitable for public recreation.

— During fiscal year 1962, a total of 19 research contracts, involving a commitment of \$720,000, were let under the Area Redevelopment Act to accelerate the development of recreational attractions on Indian reservations. New recreation facilities are being planned in Indian areas of Nevada, Oregon, South Dakota, Wyoming, Wisconsin, Colorado, and Alaska, and the tribal-owned Fort Apache Reservation's White Mountain enterprise in Arizona is expanding recreational development from seasonal to year-round use.

Other Highlights

— The Senate approved and the House gave preliminary consideration to legislation authorizing a study of the Nation's ocean, lake, and river shorelines to develop a Federal-State shoreline preservation program.

— Important new legislation will permit the orderly movement of millions of acres of agricultural land not needed to produce food and fibers to recreational and other uses.

— A Presidential recommendation that the Federal Surplus Property Disposal Act be amended to permit States and local governments to acquire surplus Federal lands for park and recreation uses on more liberal terms is awaiting congressional action.

— Recognition of the interrelationship of the nations of the world in developing plans to meet recreation needs was given with convening in June 1962 of the First World Conference on National Parks in Seattle, Wash., attended by delegates from 63 nations.

The Need for Open Space

"It is our task in our time and in our generation," President Kennedy has said, "to hand down undiminished to those who come after us, what was handed down to us by those who went

before, the natural wealth and beauty which is ours . . . an America of open spaces, of fresh water, of green country; a place where wildlife and natural beauty cannot be despoiled, where increasing urbanized population can still find the spiritual strength upon which our greatness as a country depends."

That we as a nation have neglected this task in recent decades is seen in the fact that from 1900 through 1920 we added 8½ million acres to the Federal system of parks and monuments administered by the Department's National Park Service; in the next 20 years the figure rose to well over 10 million; but from 1941 to January 1961 the total additional space set aside for the use and enjoyment of all the people amounted to just over 92,000 acres.

The unimpressive record of the past 20 years has corresponded with a period of unparalleled population growth—and with a rediscovery by millions of Americans of the value of the out-of-doors. It is an almost incredible fact that 90 percent of our people now take part in some form of outdoor recreation. This translates into 4½ billion individual recreation activities a year. By far the greatest single recreational attraction is water, and last year well over 100 million citizens were estimated to have participated in some form of water recreation. In 1961, some 16½ million Americans crowded our campgrounds—a gain of about 2 million in a single year. Many



Open space is being given more emphasis today than in many years. An example of the peace to be found in the out-of-doors is seen in this view at the Grand Canyon of the Yellowstone.

additional millions hunted, fished, skied, or took part in some other form of outdoor recreation.

In his 1962 message to the Congress on conservation, the President pointed out that we may look forward to still heavier demands for recreation facilities in the years ahead.

In response to his 1961 natural resource message, the 1st session of the 87th Congress had authorized establishment of the great outer beach of Cape Cod as a National Seashore Area, the first major addition to the National Park System in 14 years.

In 1962, the Congress moved even more rapidly to meet recreational needs with approval of an 80½-mile-long national seashore park preserving the unspoiled natural beauty of Padre Island off the coast of Texas, and authorization of the establishment of a third new National Seashore Area at Point Reyes, an undeveloped area of great beauty just 30 miles from San Francisco.

These three actions alone added considerably more acreage to the National Park System than the total additions of the previous 20 years. Prior to 1961, only 336 miles of the Atlantic coast and 296 miles of the Pacific shorelines were available as public lands. The three new seashore areas provide the American people with nearly half again that total—some 285 miles of unspoiled seacoast for public use.

Other Additions

Visitors to our network of national parks and monuments now total more than 85 million annually. Since January 1961 the process of enriching and rounding out this great network also has included this progress through both Congressional and executive action:

— The world-famous 10,023-foot Haleakala Volcano in Hawaii became the center of a new National Park—the 30th in the Federal system and the first to be established since 1956.

— Hawaii's new City of Refuge National Historic Site preserves the "sacred" ground where vanquished Hawaiian warriors of old could find a guarantee of sanctuary.

— In the Virgin Islands, the new Buck Island Reef National Memorial protects one of the finest marine gardens in the Caribbean Sea.

— The first pioneer settlement of the lower Mississippi Valley is commemorated by the new Arkansas Post National Memorial.

— An archeological record of human habitation from 6000 B.C. to about A.D. 1650 is contained in Alabama's new Russell Cave National Monument.

— The new St. Thomas National Historic Site contains Fort Christian, completed in 1680—the oldest existing structure in the Virgin Islands.

— New York City's new Theodore Roosevelt Birthplace National Historic Site preserves the home where Roosevelt spent part of his childhood, and Sagamore Hill National Historic Site protects the Long Island mansion which was the 26th President's home from 1887 until his death in 1919. Both were gifts this year to the Government and the people from private philanthropic individuals and organizations.

At the same time, the groundwork was laid for Congressional action on the establishment of additional park areas recommended by President Kennedy in his 1962 conservation message.

Reclamation's Contribution

While Reclamation projects are constructed to provide such primary benefits as irrigation, hydroelectric power, municipal and industrial water, and stream control, they also provide recreational benefits which are becoming increasingly important with the rapid increase in population.



Federal reservoirs provide recreation at an ever-expanding inland shoreline for a growing number of Americans. This is a scene at the Colorado-Big Thompson project at Grand Lake, Colo.

For example, a significant portion of the growing demand for outdoor recreational opportunities in the Pacific Northwest is being met by facilities of Bureau of Reclamation projects. Almost 4 million visitor days were recorded at some 65 different recreational areas during 1961—a 30-percent increase over 1958. During the first half of 1962, 91,700 visitors took advantage of the self-guided tour at Grand Coulee Dam. The comparable figure for 1961 was 40,000.

Another major attraction for tourists has been the construction of Glen Canyon Dam on the Colorado River in Arizona. A temporary tourist center was completed in June 1961. Farther down the river, in June 1962, nearly 70,000 visitors toured Hoover Dam.

In total, visitors to the some 190 manmade reservoir lakes of the Bureau of Reclamation in all areas of the West now approximate 26 million annually—indicating America's appreciation of this major new recreational resource. This represents an increase of one-third over 1958, and a quadrupling of use since 1950.

Joint Effort Required

Referring to the immensity of the effort which will be necessary to provide adequately for the Nation's foreseeable requirements for recreational space and facilities, President Kennedy, in his 1961 special message to the Congress on natural resources, said: "It is not a task which should or can be done by the Federal Government alone. Only through the fullest participation and cooperation of State and local governments and private industry can it be done wisely and effectively."

Working in close coordination with the President's new Recreation Advisory Council, the Department's Bureau of Outdoor Recreation has made significant progress toward achievement of this aim. In the 6 months or so since its establishment, the Bureau has held exploratory meetings with many State officials looking toward establishment of Federal grants-in-aid and technical service assistance programs.

Sport Fisheries and Wildlife

In the past decade, while the U.S. population increased by almost 20 percent, total hunting and fishing licenses sold almost doubled the rate of population increase.

At the same time, rapid advances in engineering techniques have made possible a vastly accelerated exploitation of natural resources—with corresponding reductions in favorable wildlife environment.

Wildlife, therefore, is caught in a squeeze from two directions: diminishing habitat and increased demand.



How progress in urban development threatens wetlands needed for fish and wildlife protection is graphically illustrated in this Florida area.

The growing intensity of the demand for this form of outdoor recreation may be seen in the fact that, in 1960, nearly 25.5 million anglers spent \$2.7 billion and drove 18.8 billion miles. During the same year, 14.6 million hunters spent more than \$1.6 billion and drove 7.6 billion miles in pursuit of that sport. It is estimated that one man in every four goes fishing today, one in every five goes hunting and the percentage is still rising.

One problem in attempting to meet the tremendous demand for hunting and fishing opportunities may be seen when these facts are considered: Wetlands are, acre for acre, considered to be the most productive wildlife habitat. The most recent wetlands inventory of the Department's Fish and Wildlife Service, published in 1961, listed 38 game and fur-bearing species—in addition to great flights of waterfowl—making use of one or more of the 20 types of wetlands in the various States. It is estimated that there were 127 million acres of these marshes and swamps when white men first appeared on this continent. Through drainage, flood control, and other measures this area has been reduced to about 74.5 million acres, of which only 22.5 million is considered good wildlife habitat.



Ducks in flight over feeding station at North Dakota refuge. The 87th Congress—in one of its major conservation actions—authorized the Department to “borrow” funds against future duck stamp revenue to accelerate wetlands purchase.

Action to Meet the Problem

To meet this two-pronged problem, the Congress—in one of its major conservation actions of 1961—approved a departmental proposal that it be allowed to “borrow” funds against future duck stamp revenue to speed up wetlands purchase.

That extraordinary action was sorely needed is shown in the fact that, before 1961, land acquired for Federal wildlife refuges cost an average of \$12.40 an acre; in fiscal year 1961, this average price increased to \$69.39 an acre; while in the 1962 fiscal year the average price was \$86.71 per acre.

With an authorized 7-year advance of \$105 million to acquire land ahead of rising prices, the Department of the Interior, under the new legislation, has been enabled to move forward with a greatly accelerated program for the preservation of wildlife as a major recreational resource. The Department's 7-year program contemplates the acquisition of 2,950,000 acres of land. Of this total, about 1.2 million acres will be for new migratory waterfowl refuges or additions to

existing refuges. The remaining 1,750,000 acres will be for waterfowl production areas in the prairie States. In fiscal year 1962, funds were obligated for the acquisition of 18,915 acres for refuges and 16,649 acres for wildlife production areas in 16 States. At the same time, additional funds were obligated for 16,650 acres of small wetlands for waterfowl production in North and South Dakota and Minnesota.

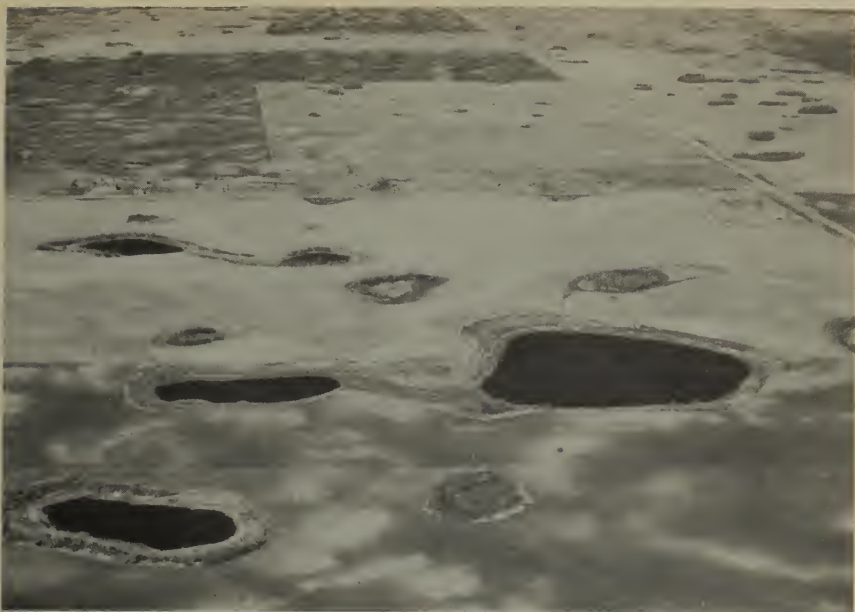
The especially acute problem confronting these three prairie States was pointed up in the report of the Senate Select Committee on National Water Resources. The rapid decrease in wetlands, the report said, "is particularly acute in a 56,000-square-mile area of the northern prairies in Minnesota, North Dakota, and South Dakota. In that section there exists the most valuable area for waterfowl production in the coterminous United States. Since 1943, an estimated 1,027,000 acres of this area has been destroyed by the expenditure by the Federal Government of an estimated \$25 million for farm drainage."

It was with particular reference to this problem that President Kennedy told the Congress in his 1962 conservation message: "I am hopeful that consistent and coordinated Federal leadership can expand our fish and wildlife opportunities without the present conflicts of agencies and interests: One Department paying to have wetlands drained for agricultural purposes while another is purchasing such lands for wildlife or waterfowl refuges."

Progress Through Coordination

Taking cognizance of the urgency of the problem, the 87th Congress undertook positive corrective action with passage of legislation providing that the Secretary of Agriculture may not grant technical or financial assistance for drainage projects in Minnesota or the Dakotas which are found by the Secretary of the Interior to be harmful to waterfowl, if within 1 year the Fish and Wildlife Service or a State fish and game agency offers to lease or purchase the affected wetlands. This important legislation had the endorsement of both Departments. Even prior to its passage the two agencies had reached administrative agreement on a joint drainage-project policy which has permitted substantial progress in protection of threatened waterfowl production areas in the Prairie States as well as in other regions.

Meanwhile, through agreement reached between the Department of the Interior and the Army early this year on the protection of lands around Federal reservoirs, fish and wildlife and outdoor recreation programs have been considerably accelerated. Under the previous policy, adopted in October 1953, the Bureau of Reclamation and the Corps of Engineers obtained land title only to a relatively narrow strip around reservoirs. The new policy provides for the acquisition



Pothole areas of Central States, vital waterfowl breeding grounds, are now being saved by the Department through expanded program for protection of wildlife.

of sufficient land to meet both present and future requirements for recreation and fish and wildlife development and management.

Progress Through Cooperation

In April 1961, the Department announced inauguration of a new type of public land management program with formal designation of a 92-square-mile Federal-State cooperative land and wildlife management area in south-central California.

Created by this pioneering agreement was the Caliente National Cooperative Land and Wildlife Management Area consisting of 58,868 acres of public lands to be administered by the Bureau of Land Management in cooperation with the Fish and Wildlife Service and the State of California. Through a cooperative program, the Department and the State agreed to jointly develop the wildlife, recreational, and other natural resources of the area, noted for its quail and partridge hunting.

In little more than a year, 10 additional cooperative areas had been established, assuring the development of the recreational and fish and wildlife potentials of hundreds of thousands of acres to meet the needs of California's expanding population.



Congress has authorized the development of outdoor recreational resources for public use at wildlife refuges, so long as basic objectives of wildlife management are not hindered.

Contribution to Recreation

The important contribution made by our National Wildlife Refuges in providing outdoor recreation opportunities is shown by the 11 million visitors to those areas in 1961—a figure more than tripled in 10 years.

A long existing difficulty in this regard has been the fact that the refuges are not equipped with either facilities or personnel to accommodate this large and rapidly increasing influx of visitors.

The 87th Congress took action to remedy this situation through passage of legislation formally authorizing use for recreation of facilities at wildlife refuges and fish hatcheries provided it does not interfere with primary conservation objectives.

With this authorization, the Department of the Interior is enabled to proceed with the installation of recreational facilities, including picnic areas, swimming beaches, and boat docks, at about 200 federally operated hatcheries and refuges.

Other Progress

Other highlights of the significant progress in fish and wildlife resource development since January 1961 include:

— Four new wildlife refuges have been established—in Ohio, Michigan, Mississippi, and Georgia—and the Migratory Bird



Expansion of the Department's fish and wildlife program is marked by establishment of marine laboratories such as this one at Tiburon, Calif.

Conservation Commission has approved (a) the creation of three additional new wildlife refuges; (b) enlargement of nine existing wildlife refuges; and (c) the acquisition of lands for five additional waterfowl refuge projects. In all, a total of well over 100,000 acres is scheduled to be added to the Nation's wildlife and waterfowl sanctuaries under these actions.

— The Department has approved an order setting aside public lands in Utah for a new national fish hatchery which promises important benefits to that State's economy and recreational fishing.

— A new marine laboratory has been established at Sandy Hook, N.J., to study management of salt-water sport fish—the basis of a growing industry.

— A national reservoir fishery research program has been launched with establishment of two new research centers in South Dakota and Arkansas.

— Preliminary hearings paved the way for Congressional action on legislation to safeguard for waterfowl use the vital Klamath-Tule Lake wildlife area near the California-Oregon line. The legislation—which would solve a problem that has been under discussion for over 20 years—is designed to permit present agricultural use while simultaneously protecting waterfowl rights in three refuges.

— Valuable new progress has been made in studies of diseases and pesticides by the new Federal Pest Control Review Board, established in 1961 because of concern over losses of fish and wildlife and possible hazards to public health because of increasing aerial spraying of poisonous pesticides.

— An advisory board composed of distinguished wildlife experts and conservationists has been appointed to assist in formulating wildlife management programs and policies on lands administered by the Department of the Interior.

— Recognition of the growing need for knowledge, particularly among young students, of our fishery resources, was provided by Congress in authorizing establishment in Washington, D.C., of a \$10 million National Fisheries Center and Aquarium. In addition to educational benefits for many thousand of visitors to the Capital, the new center will make significant contributions to numerous scientific studies including medical and biological research.

Public Land Resources

One hundred years ago the Congress passed the Homestead Act—providing a significant stimulus to our national development.

In the century that has followed, more than 1.1 billion acres of the original public domain have been transferred to private and non-Federal public ownership.

Today, the 768 million acres remaining in Federal ownership represent one of our most important assets, with the millions of acres set aside for national parks, forests, and wildlife refuges contributing increasingly to the national welfare.

Yet, exclusive of Alaska, 180 million acres of public-domain land awaits the realization of its full potential.

It was in cognizance of this fact that President Kennedy in his February 1961 conservation message to the Congress described unused public land as “a vital national reserve that should be devoted to productive use now and maintained for future generations.”

“Much of the public domain,” he wrote, “suffers from uncontrolled use and a lack of proper management. More than 100 million acres of our Federal Grazing Districts are producing livestock forage well below their potential. We can no longer afford to sit by while our public domain assets so deteriorate.”

In response, the Department of the Interior immediately took action on a broader scale than any undertaken in many years to assure better usage of, and more adequate returns from the resources of the public land.

Within weeks, an 18-month moratorium was ordered on most types of nonmineral applications for land of the public domain of which there then existed an overwhelming backlog—representing the accumulation of three to four years.

Aims of the Moratorium

The moratorium allowed time for three critical activities by the Department:

First: Reduce the backlog of applications to manageable proportions.

Second: Move forward with a long-needed comprehensive inventory, evaluation, and classification of public lands; and,

Third: Review and revise Departmental regulations and initiate legislative proposals necessary to modernize the Nation's land laws.

With termination of the moratorium in September 1962, the backlog of applications had been reduced from 40,000 to 17,000.

Only through knowledge of the characteristics and capabilities of the public lands can their best usage in the public interest be achieved. More orderly handling of land office business has permitted the Department to undertake the first fully comprehensive inventory and evaluation of the national land reserve in history.

With completion of the initial phase of this large-scale project scheduled for mid-1963, the work thus far accomplished has pointed the way to important conservation gains.

An example of benefits to be realized through comprehensive and up-to-date inventories may be found in the forest resources on public lands. Under this Administration, the Department has considerably expanded its cooperative efforts with the Department of Agriculture to improve on timber sale practices and achieve a further standardization of forest inventory procedures. As a result, increases of some 175 million board feet in the annual allowable harvest of western Oregon timber lands administered by the Department of the Interior have been made possible.

Broad New Conservation Plan

As a further significant result of the 18-month moratorium order, the Department has submitted to Congress a comprehensive program for modernization of public land laws, establishing new authority to manage and develop the public lands natural resources.

Here emphasis has been placed on legislation which will authorize public lands not needed for public purposes to be leased or sold and to be transferred to private ownership as residential and business sites or to meet the needs of a modern industrial and urbanized society. Attention has also been given to bills which will simplify administrative



The public lands of the West can provide growing space for rapidly expanding urban and industrial land requirements. The Department is seeking legislation to permit orderly transfer for these purposes.

procedures for exchanges of public lands with States and individuals and to eliminate outmoded features.

The 5-year program—with projections to 1980—recommends major expansions of conservation projects on the public land reserve and accelerated efforts to provide recreational facilities, halt soil erosion, and protect forest resources. Reseeding and brush control programs on public ranges will be stepped up and fences and water-control projects will be increased. Timber stand improvement activities, such as reseedling, thinning, and pruning, will be accelerated.

One of the major elements of the plan is the development of 1,450 recreation sites on public lands. Related to this and other elements of the program is the proposed building of more than 3,000 miles of access roads before 1967.

The cost of the first 5-year phase of this comprehensive program is estimated at about \$478 million. During the same period, public land revenues will total about four times as much—almost \$1.9 billion.

Forest Planning

The Department of the Interior administers some of the most valuable Douglas-fir forests in the world. To assure their highest use and production, the Department in fiscal year 1962 undertook the



To assure their highest use and productivity, the Department has undertaken the development of an intensive new forest management program for forest lands under its jurisdiction.

development of an intensive new forest management program, including the application of long range planning techniques. Features of the program include harvesting of immature timber which would ordinarily be lost to growth competition, and an accelerated reforestation project to bring denuded commercial forest lands into full production by 1970 and assure their sustained production.

In another step to improve forest yields and expand business opportunities, the Department, in cooperation with the Small Business

Administration, has arranged for loans to small firms for construction of access roads to timber sale areas. By using these loans, smaller firms are able to compete on larger sales where considerable amounts of capital outlay are needed to develop access road systems.

Other pending changes in timber sale regulations designed to aid forestry include longer contract periods, reduction of performance bonds, cutting timber in advance of payment, and the allowance of installment payments on sales valued as low as \$500.

Range Resources

For the first time the need to reverse the trend of deterioration and to build toward full sustained-yield production of the 194 million acres of range resources administered by the Department has been placed in perspective as a major national problem.

An evaluation of the needs of the western rangelands has shown that more than 100 million acres require an immediate and intensive stepping up of conservation programs if the process of rehabilitation is to be begun.

To cope with this large-scale problem, the Department, since January 1961, has accelerated its program to improve range management, with particular emphasis on range use supervision, trespass control, and range studies.

In both 1961 and 1962, the Congress approved supplemental appropriations—the first ever granted—for work toward rehabilitation of vast burned-over range areas, and in fiscal year 1963 funds for this purpose have been made a regular part of the soil and moisture conservation budget.

Over 500,000 acres of rangelands have received conservation treatment in the form of such projects as brush control, seeding, water control structures, stockwater developments, and fences. A comprehensive weed control program has proceeded as rapidly as money and manpower will allow under cooperative Departmental research projects conducted by the Agricultural Research Service of the Department of Agriculture and by State universities in several of the States as well as direct control measures on the ground.

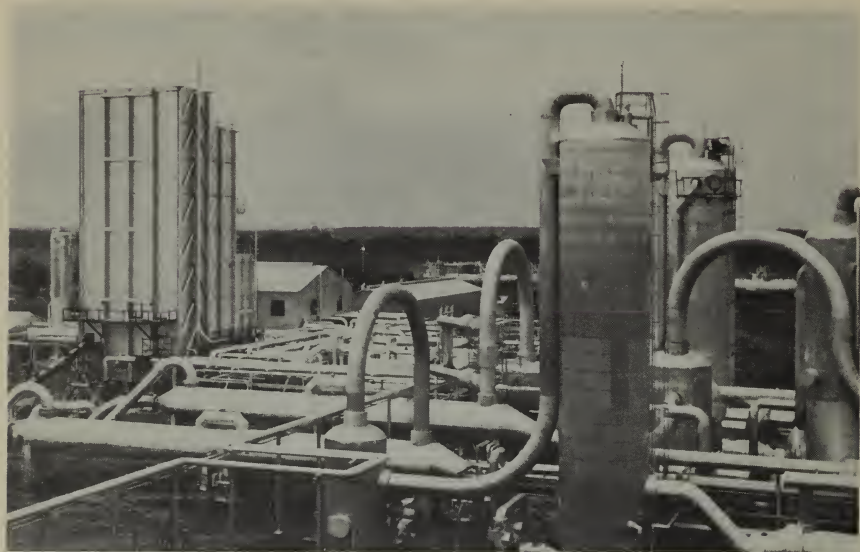
As a forerunner to a full-scale appraisal of the public rangelands, the Departments of Agriculture and of the Interior conducted a trial appraisal program on lands administered by the two agencies in Colorado, Montana, and Oregon. Undertaken at the request of the Senate Appropriations Committee, the study included such factors as suitability for livestock grazing, past and present management, range condition and trend, current and potential grazing capacity, range use by livestock and wildlife, and existing and needed conservation practices and improvements.



Department's accelerated range management program has provided more than 500,000 acres of rangelands like these with conservation treatment in the form of such projects as brush control, seeding, water control structures, stockwater developments, and fences.

Mineral and Energy Resources

In the past 30 years, this Nation has consumed more minerals than all the peoples of the world had previously used. Twice during those three decades we have doubled the money value of mineral production. That current demands are being met without difficulty is primarily



The Northern Natural Gas Co.'s plant at Bushton, Kans., is first of five constructed by private industry in Department's expanded helium conservation program.

due to the immense technical and exploratory efforts of the 1940's and early 1950's. But with national requirements constantly increasing, the present availability of raw materials will not continue unless prompt action is taken to look to the years ahead.

Since January 1961, this Administration has given strong support to legislative proposals designed to assure that the multiplied needs of the future will be met.

A clear example of these needs may be seen in the growing national requirements for, and shrinking supplies of, helium.

Protection of our irreplaceable helium resources has become increasingly important with growing use of this element in space age and nuclear technology, and in cryogenics—the rapidly expanding field of low-temperature research. Helium's unique properties of lightness, inertness, low-liquefaction temperature, and transparency to radioactive particles have caused a phenomenal upswing in demand during the past 10 years.

Helium occurs as a minor constituent of some natural gases and is extracted by a low-temperature gas liquefaction process. Unless helium is extracted from the natural gas, it is wasted when the gas is burned. In the last two decades no new sources of helium have been found comparable with those previously known. Because of this, the Bureau of Mines is extracting as much helium as is feasible and storing it underground in a depleted natural gas field. Without this program,

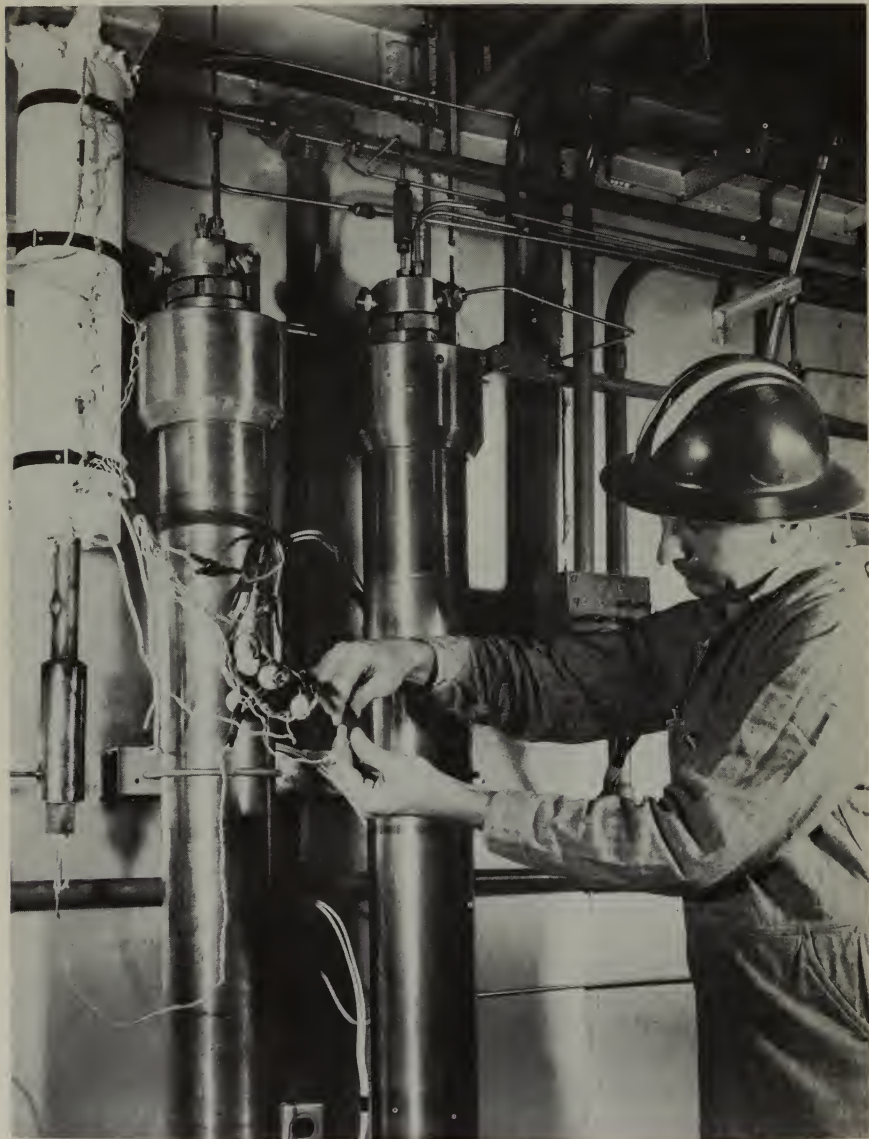
about 5 billion cubic feet of helium would be wasted annually in natural gas used for fuel.

The 1st session of the 87th Congress authorized expansion of the Department's helium conservation program and, in little more than a year following this action, contracts totaling \$47.5 million annually for up to 22 years were awarded under which private industry has agreed to build and operate five plants to extract and thus prevent waste of helium in marketed natural gas. The first of these plants



Bureau of Mines has completed 430-mile pipeline system to carry newly saved helium to underground storage in Texas.

was placed in operation, delivering its output to a 430-mile, \$8.5 million pipeline system just built by the Bureau of Mines. The new pipeline will connect all of the five new plants with four of the Bureau's production-and-purification plants and with the Cliffside gasfield near Amarillo, Tex., for underground storage. The remaining four new plants are scheduled for completion by early 1963, and the five new



Progress in efforts to find new uses for coal is marked by this experimental equipment for converting coal into oil.

installations combined will deliver more than 3 billion cubic feet of helium annually to the pipeline-storage system.

Additionally, the Bureau of Mines has made considerable progress in research on minerals processing and utilization, including preparation of steel from pyrophoric iron powders and preparation of extraordinary pure nickel and rhenium metals by solvent extraction electrolytic combination processes.

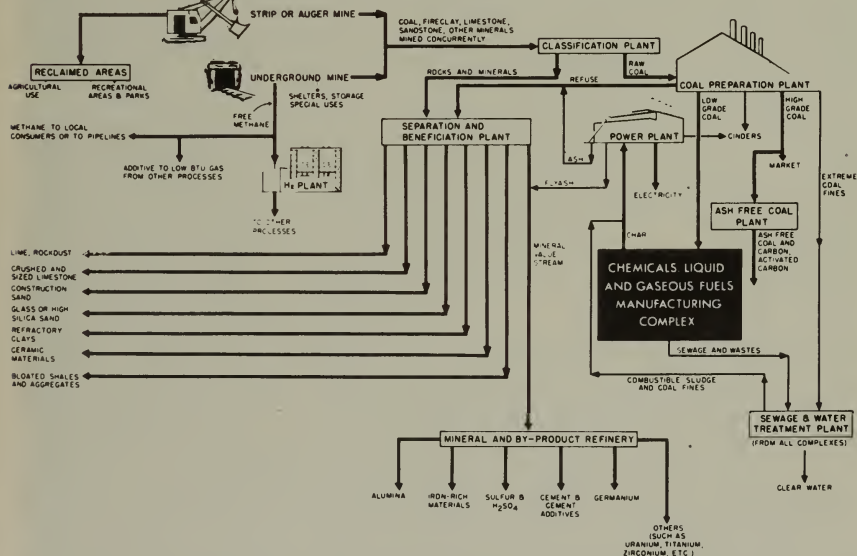
Coal—An Awakening Giant

While there are no easy answers to the many complex problems in the field of energy, major moves have been taken in recent months with the intent of expanding the use of the Nation's great coal reserves. Since January 1961, more emphasis has been placed on efforts to improve the position of the Nation's coal industry than at any other time in recent years.

One of the most significant steps in this direction was taken with establishment in the Department of a new Office of Coal Research, designed to complement the continuing research programs of the Bureau of Mines with the particular aim of achieving breakthroughs where possible on a short-range basis.

POTENTIAL MULTIPLE-PRODUCT MINING COMPLEX

OFFICE OF COAL RESEARCH, DEPARTMENT OF THE INTERIOR



One of the major efforts of the Department's new coal research program is to develop new ways to utilize fully all of the economic value in a ton of coal—its energy, chemical, and byproduct content—as shown above.

The interest stimulated by this action is shown in the fact that, since its establishment, the Office has received more than 250 research proposals from private companies, individuals, research organizations, and educational institutions. In fiscal year 1962, contracts with a total value of nearly \$3 million were granted for research in the fields of coal production, utilization, processing, equipment, and transportation.

At the same time, continuing progress has been reported by the Bureau of Mines in major coal research projects, including hydraulic mining, conversion of coal to high B.t.u. gas, development of a practical coal-burning turbine engine, and conversion of coal to liquid and gaseous fuels.

Breakthrough in Transportation

One of the major disadvantages of the coal industry in attempting to compete in the energy markets with other fuels has long been the problem of transportation.

A possible breakthrough in this regard may be found in the relatively recent development of a coal slurry—a mixture of coal and water—which can be fed directly into boilers for producing steam to generate electricity.

This slurry is capable of being transported through pipelines similar to those used for oil, and proposed new legislation would facilitate the construction of interstate pipelines—through Federal use of the right of eminent domain and by other means—to transport slurry from minemouth to large energy users.

Interior Department technicians conducted a study for the President's Panel on Civilian Technology which demonstrated that the pipelining of coal could have a healthy effect on the coal industry. Among benefits could be substantial improvement of economic conditions not only in the coal industry but in many coal mining communities that presently are in a seriously depressed condition.

Other Highlights

Meanwhile, other highlights in the Nation's minerals conservation progress since January 1961 included:

— The first Federal mineral leasing on the Pacific coast Outer Continental Shelf marked a conservation landmark when some 80,000 acres of submerged lands off the coast of southern California were offered for competitive phosphate leasing. Also, large blocks of Outer Continental Shelf lands off the gulf coast—including nearly 2 million acres off Louisiana and Texas—were leased for oil and gas exploration with bonus bids totalling more

than \$445 million—the largest amount ever received in a single Federal lease opening.

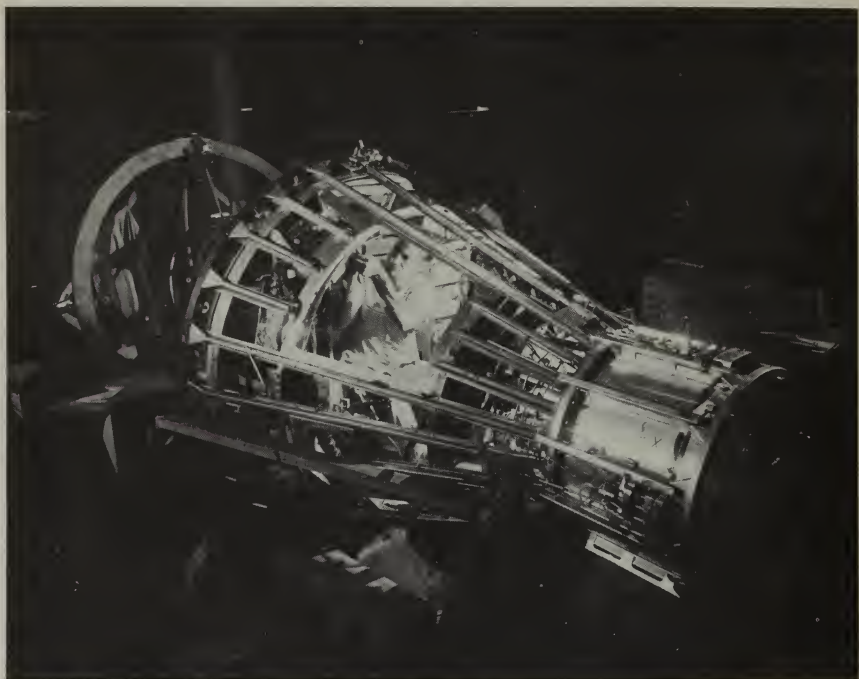
— In another pioneering step contributing both to conservation and the national security, the Department completed preparations for the opening of bids in January 1963 covering the first lease-sale of Federal oil and gas lands off the coast of California. Development of the oil resources covered by this sale will provide a significant stimulus to the economy of northern California while adding to vital national emergency reserves.



Development of oil potential of Outer Continental Shelf lands in Pacific Ocean and Gulf Coast is being accelerated by the Department of the Interior.

— Fiscal year 1962 applications for minerals exploration assistance increased 175 percent over 1961 following the revision and streamlining of Office of Minerals Exploration regulations, including the addition of gold, silver, and iron ore to the eligibility list.

— The Department's Geological Survey discovered new deposits of beryllium ore in the Lost River area of Alaska, about 70 miles northwest of Nome. Beryllium, a scarce metal worth approximately \$70 a pound, is valuable as a strengthening and hardening material when alloyed with copper and nickel and also has considerable potential for use in supersonic planes, space craft, missiles, and nuclear reactors.



Titanium metal, produced with techniques pioneered by the Department's Bureau of Mines, was used in the framework and "skin" of the Mercury capsule's cabin, helping to shield astronauts from the high temperatures encountered in the frontiers of outer space.

— Oil and gas exploration, development, and production in Alaska has experienced a sharp increase, particularly on the Kenai Peninsula, in a development expected to stimulate the economic growth of that State and provide additional incentive for further mineral exploration.

— The Bureau of Land Management has begun an inventory of the known mineral resources and potential minerals areas under the Department's administration to provide a basis for a more effective management program.

— The Geological Survey inaugurated a long-range geologic mapping program to provide information for the classification of Federal lands valuable for such leasable minerals as coal, oil shale, oil and gas, phosphate, potash, and sodium, with the objective of making some 50 million acres of withdrawn Federal lands subject to public land laws.

— Reopening of the Government's experimental oil shale plant at Rifle, Colo., an important link in efforts to find new uses of oil shale through concentrated research, was authorized by the 2d session of the 87th Congress.

— Action was taken to strengthen the oil import control program. Provision was made for "new comers" to obtain allocations of residual fuel oil based upon terminal throughputs, whereas previously the program was limited to historical importers. The crude oil import program was made more responsive to the needs of the oil industry by reducing the number of steps in the sliding scale for allocation holders on "refinery inputs" basis from eight to four.

Indian Affairs

In the past 2 years this Administration has moved forward rapidly in a new program for the Indians which places emphasis on preparing the Indian population for full, equal participation in all aspects of our national life.

President Kennedy outlined his views on Indian policy soon after his election when he said: "We want every group which is now unable to make its full contribution to American strength to be given the opportunity to do so. It is in this spirit that we shall approach our work on Indian reservations, and it is in this spirit, I am sure, that Indians throughout the country will work together for a better life for themselves and thus a stronger America."

In February 1961, a special task force was appointed by the Department to make a thorough study of the problems and programs affecting the lives of the 380,000 Indians still receiving services from the Bureau of Indian Affairs, and to put forward recommendations looking toward "a better life" for these Americans.

In July of that year, the task force—after traveling 15,000 miles and conferring with the representatives of 200 organized tribes—completed its report. The comprehensive document recommended

programs and actions designed to blaze a new trail in Indian development.

Probably the most significant paragraph of the report was this:

"The task force believes that in the foreseeable future, the proper role of the Federal Government is to help Indians find their way along a new trail—one which leads to equal citizenship, maximum self-sufficiency, and full participation in American life. In discharging this role, it must seek to make available to Indians a greater range of alternatives which are compatible with the American system, and, where necessary, to assist Indians with choosing from among these alternatives. As a part of this responsibility, it must mobilize and direct the vast reservoir of good will toward Indians which is found throughout the country."

Highlights of Progress

Prompt action to implement the task force recommendations came not only from the Department but from the Congress. The subsequent 18 months of record progress toward self-sufficiency have been marked by these highlights:

— Under the Area Redevelopment Act, 56 reservations and four areas in Alaska—containing about two-thirds of the total Indian population—have been made eligible for special aid to assist in overall economic development. Some 50 Indian tribes have applied for ARA grants for studies of economic development possibilities, and in fiscal year 1962 a total of 19 research contracts were let, involving a commitment of \$720,000, with particular emphasis on the development of new recreational and tourist attractions. Included in the ARA studies now underway is a project to determine improved methods for expanding the Alaskan native arts and crafts market.

— The Bureau of Indian Affairs' adult vocational training program has been accelerated and expanded as the result of action by Congress increasing the authorized amount of appropriations for the program from \$3.5 to \$7.5 million annually.

— Similarly, an increase from \$10 to \$20 million in authorized appropriations has made possible substantial expansion of the Bureau's revolving credit program for Indians.

— The program of school construction on reservations has been considerably accelerated, with the provision of facilities for all Indian children needing educational opportunities now scheduled for the end of fiscal year 1965.



Indian educational opportunities are being expanded. This class at Eagle Butte, S. Dak., is in a school jointly operated by the Bureau of Indian Affairs and the local public school district.

— A new milestone in Indian education was reached with the opening in Santa Fe, N. Mex., of the Institute of American Indian Arts. Current enrollment of about 150 students in the 3-year high school and 2-year postgraduate course includes Indian young people from all parts of the United States. An additional 180 students are continuing with regular academic studies at the school in 1962–63. The institute offers a regular high school curriculum plus special training in applied and creative arts.

On-Job Training

— Since the summer of 1961, the Bureau of Indian Affairs has been making greater use of work forces which it recruits and supervises directly for construction work on schools, roads, irrigation projects, and other facilities. Previously, all such work was done by private contractors who recruited and supervised their own work forces. The major advantage of the new method



Indian woman working on rug is symbolic of departmental efforts to develop and protect Indian art as unique cultural craft.

is that it provides local Indians with more employment opportunities as well as providing on-the-job training in the use of heavy equipment and in other phases of construction work.

— The Department and the Federal Housing Administration have entered into an agreement designed to increase the availability of FHA-insured financing for home construction and housing improvements on reservations. In addition, approval was given by the Public Housing Administration for a low-rent

public housing project on the Pine Ridge Reservation in South Dakota—the first such project on Indian lands—and similar projects on other reservations are in the planning stage.

Territorial Progress

The territories under U.S. administration have made substantial progress since January 1961 under the Kennedy Administration policy of promoting self-government and encouraging expanded social and economic development.

Congressional support of the President's endorsement of programs "commensurate with the responsibilities of our stewardship" was reflected in legislation raising the appropriations ceiling for the widely scattered islands of the Pacific Trust Territory from \$7.5 to \$15 million in 1963, and \$17.5 million thereafter. A major result of this action has been the acceleration and expansion of programs of the Depart-



Improvement of agricultural development is one of Department's principal aims in territories under its jurisdiction. This is an example of nut clusters on a choice mother palm tree in Yap District, Trust Territory of the Pacific. The Yap Islands are a particularly good source of seednuts. Trees are selected and marked as sources of nuts for planting throughout the Territory.

ment's Office of Territories to provide increased educational opportunities for the islanders.

An important step toward the development of competent self-government also was taken with establishment of a new capital of the Trust Territory—including the Marianas, the Marshalls, and the Carolines—on the island of Saipan.

Guam Restrictions Lifted

Following negotiations between the Departments of Interior and Defense, security restrictions which have hampered tourism and economic growth have been lifted for Guam and considerably lightened for the Trust Territory. Through Presidential action, Navy security clearances no longer will be required as a condition of entering the territory of Guam, thus providing the same freedom of movement that exists in other parts of the United States. Additionally, the President directed the Secretaries of State, Defense, and Interior to develop revised procedures which will facilitate free entry of U.S. citizens, U.S. investment, and U.S.-flag vessels into the Trust Territory.



Pago Pago Harbor in American Samoa, one of the most beautiful in the world, now shines with new buildings on waterfront.

Other Highlights

Following are additional highlights of territorial progress:

— A new \$4.5 million jet airstrip on Samoa—designed to open the way for tourist development—has been placed in operation. Jet service to Samoa reduces by half the previous 8-hour travel span from Hawaii.

— Three new high schools have been completed on Samoa and preliminary work is underway on 5 new junior high schools and 20 new elementary schools in an accelerated educational program made possible by a Federal appropriation of \$9.6 million for the island in fiscal year 1962, more than 4 times the amount previously available. Eleven miles of modern roads, first on the islands, have been completed, new electrical generating equipment has been installed, and additional road, hospital, and sanitation facilities are on the drafting boards.

— The new College of Guam, providing higher education for Guamanians as well as students from the trust territory, is now in operation, and progress is being made toward elimination of a dual wage situation whereby Guamanians have received less than U.S. employes doing similar work.

Food From the Sea

Hunger is the greatest human problem facing the world today. More than half of the world's population—some 2 billion people—suffer from a lack of food supplies which are adequate in quality and quantity to sustain desired levels of health, growth, and vigor. And the problem will be vastly intensified by the year 2000 when the present world population shall have more than doubled.

Widespread malnutrition, and undernutrition, is largely due to inadequacies of high quality protein in the human diet. The only readily available source of inexpensive animal protein in sufficient quantities to remedy this diet deficiency is in the sea in the form of fish. Fish can supply these diet deficiencies in the form of concentrated protein. Wisely utilized and managed, the sea with its vast fish populations represents an almost unlimited reservoir of high quality animal protein.

In his 1961 message on natural resources, President Kennedy gave special emphasis to this point when he said:

“The sea around us represents one of our most important but least understood and almost wholly undeveloped areas for extending our resource base . . . Salt (and fresh water) fisheries are among our most important but far from fully developed reservoirs of protein foods. At present levels of use, this country



Departmental oceanographic research programs help to assure catches like this for Nation's fisheries industry.

alone will need an additional 3 billion pounds of fish and shellfish annually by 1980, and many other countries with large-scale protein deficiency can be greatly helped by more extensive use of marine foodstuffs.

"But all this will require increased efforts, under Federal leadership, for rehabilitation of depleted stocks of salmon and sardines in the Pacific, groundfish and oysters in the Atlantic, lake trout and other desirable species in the Great Lakes, and many others through biological research, development of methods for passing fish over dams, and control of pollution.

"This Administration intends to give concerted attention to our whole national effort in the basic and applied research of oceanography. Construction of ship and shore facilities for ocean research and survey, the development of new instruments for charting the seas and gathering data, and the training of new scientific manpower will require the coordinated efforts of many Federal agencies."

Action Set in Motion

In implementation of the President's suggestions, Government and many private agencies engaged in the marine sciences have embarked on a long-range program of oceanographic research. This large and important undertaking is being coordinated by a special Interagency Committee on Oceanography. The work of this Committee is designed to meet the divergent needs of commerce, defense, atomic energy development, and production of mineral and fishery resources.

Four Bureaus of the Department of the Interior are taking a significant part in this new program: the Bureau of Mines, Sport Fisheries and Wildlife, Commercial Fisheries, and the Geological Survey. The Bureau of Commercial Fisheries, being responsible for support of the fishing industry and for development of sea food resources, has a large share of the Department's marine sciences program. In this work, it operates in close collaboration with the Navy Department, the Atomic Energy Commission, the National Science Foundation, and other agencies in Government and the various State and private research institutions.

Fish Protein Concentrate

Apart from the purely humanitarian issues, there are other compelling aspects to what represents the greatest and most interesting challenge in this substantial new program—that of helping to find answers to the world's hunger problems. For example, the mass-scale production of a satisfactory fish protein concentrate would provide a tremendous economic stimulation for our domestic fishing industry. Production of fish protein concentrate would help to diversify the markets of our industrial fisheries. It would assist in restoring the ecological balance of the oceans by utilizing the many species of fish now ignored or wasted by commercial fishermen. It would provide a market for the great quantities of fish inadvertently taken along with the more valuable varieties and are now discarded at sea because no markets exist for them. In many areas, glut periods lower the price of even the valuable catch and frequently, even for these desirable species, no market is available. If, however,

the processor were able to manufacture fish protein concentrate during these periods of surplus, markets would tend to stabilize, and hungry people in all parts of the world would benefit.

Today, as the result of concentrated research, a final breakthrough in the development of a fish protein concentrate satisfactory to the requirements and needs for quantity production and distribution appears close at hand.

Congress Increases Appropriations

Closely allied with the problem of meeting world food needs, and with finding new markets and uses for our fishery products, is the problem of finding ways and means of catching fish more efficiently, of knowing where they are, and determining the factors which have a bearing on their abundance.

With increased appropriations provided by the Congress, considerable progress is being made in obtaining the ships and shore facilities needed for modern fishery oceanographic research on the scale now being undertaken.

Funds were budgeted to the Bureau of Commercial Fisheries to build a new laboratory at La Jolla, Calif., and to make improvements to existing laboratories at Auke Bay, Alaska, Oxford, Md., and Boothbay Harbor, Maine. In addition, a new sea-water system and building for experimental studies on fish and shellfish has been completed at the Galveston, Tex., laboratory. A new 180-foot biological and oceanographic vessel has been launched at Slidell, La., for operation in Atlantic waters, and plans are being developed for new research vessels for use in the Central Pacific, in the North Atlantic, and in the Gulf of Mexico. Additionally, funds are budgeted in fiscal year 1963 for a new oceanographic ship for operation in Eastern Pacific waters and for a \$2 million laboratory at Seattle, Wash.

To increase the supply of trained oceanographers and fishery biologists and technologists needed to undertake this research, the Bureau of Commercial Fisheries has set up a program of grants for training of graduate students in universities throughout the country. This will provide financial support to about 17 graduate-level students during the 1962-63 academic year, and it is expected that this number will be increased in succeeding years.

New Research Starts

While emphasis has been given in the early phases of the oceanographic program to improvement of facilities and increasing scientific manpower, important new starts in research also have been made.

Initiated this year were expanded studies of gulf estuarine waters. These waters are potentially as productive as much of our farmland,



Bureau of Commercial Fisheries research vessel is part of Department's growing oceanography program

but we have not yet developed methods of culture that will permit maximum use of their potential. Biologists have learned that these areas serve as nursery grounds for larvae of many varieties of commercial species of shrimp and fish which are taken as adults in the offshore waters of the Gulf. They also provide a large portion of the Nation's oyster supply. Fishery scientists have advocated studies of estuarine waters for the past several years because they have been concerned about the loss of this environment through the dredging of channels for real estate and other commercial developments. The goal of this new research is to determine if these engineering developments are harming resource production and, if so, to find ways to prevent it.

A new program of oceanographic research in the tropical Atlantic Ocean is being organized this year. The objective of this activity is to investigate the fishery potential in this important region. The first fieldwork will be on the eastern side of the Atlantic to define the environment in which important high-seas tuna populations and other valuable fishery resources are known to exist.



Gill nets are part of equipment used in Department's high seas salmon research program.

Alaska Salmon Research

Information necessary for successful renegotiation of the International North Pacific Fisheries Convention is the objective of an emergency salmon research program in Alaska. The convention—between Japan, Canada, and the United States—became effective in 1953, and may be terminated, amended or continued in 1963. The research program, undertaken by Bureau of Commercial Fisheries laboratories and with contract work being done by the Alaska Department of Fish and Game and the Fisheries Research Institute of the University of Washington, is nearing completion. It has increased our knowledge of optimum spawning escapements, carrying capacity of lakes, and spawning characteristics necessary to support the Bristol Bay red salmon runs.

High seas salmon research reached maturity with emphasis on high seas tagging and sampling. This has provided new information on locations and ocean migration habits of different stocks of salmon.

The proposed development of the Middle Snake River, an important tributary of the Columbia River, resulted in a new program oriented to the problem of fish passage, posed by construction of high dams.

The State fisheries agencies of California, Idaho, Oregon and Washington are cooperating with the Bureau of Commercial Fisheries in developing techniques and equipment, and in research.

Great Lakes Rehabilitation

One of the most encouraging developments to the commercial fishing industry has come in the Great Lakes where a large-scale sea lamprey invasion had for some years all but put an end to the highly profitable lake trout catch.

Today, a two-pronged attack on the predators gives promise that full-scale lake trout fishing may be restored. Under the auspices of the International Great Lakes Fishery Commission, the Bureau of Commercial Fisheries and the Fisheries Research Board of Canada treated with a selective toxicant all tributary streams of Lakes Superior and Michigan known to contain larval sea lampreys. This major experiment in chemical control of an undesirable species shows every promise of ultimate success.

At the same time, artificial propagation has been used to restock Lake Superior with lake trout. Survival of hatchery-planted trout is excellent and growth rapid, indicating a promising future for rehabilitating the lake trout fishery.

International Cooperation

Since January 1961, this Government has been seeking, more earnestly than ever, to promote the conservation of natural resources in foreign countries. The two basic reasons for this renewed emphasis are quite obvious: First, these activities further the objectives of the U.S. foreign aid program through helping millions of free people find their way to a better life; and, second, they also help assure adequate future supplies of raw materials which the United States must seek abroad.

The views of the Kennedy Administration in this regard were expressed by President Kennedy when he said: "Just as our investment of scientific talent, money, and time is better utilized in well coordinated and complementary programs within the Federal Government and by the closest working relationships with State and local governments, the academic community and industry, so our efforts should be meshed with those of the other countries of the world.

"Resource conservation problems are world-wide; efforts to solve them should be equally universal. This Nation will continue to cooperate in international scientific and research undertakings; and the useful information and specific technological applications

we develop—economically feasible desalinization of sea water, for example—will be made available immediately, as has always been our practice, to advance the welfare of all peoples of the world.

Mineral Conservation

The expanding scope of our efforts in this field are particularly evident in international collaboration in minerals programs. Despite the richness of its domestic resources this Nation is notably deficient in certain minerals. Working in cooperation with the Agency for International Development, engineers of the Bureau of Mines are making substantial progress in helping to advance the development of mineral resources abroad.

Throughout our industrial history, we have depended on foreign sources for our tin supplies. One of the major world producers of this metal in Indonesia, where recent serious declines in mining efficiency have threatened the industry's ability to continue as a leading producer. Bureau of Mines engineers on technical assistance assignments in Indonesia have repeatedly advocated detailed study of the industry to determine the best solutions to its difficulties. Their efforts now have borne fruit. An American consulting team has been assigned to undertake a comprehensive study of all facts of Indonesian tin mining and this investigation is presently well underway.



The Department is assisting in mapping vital Pakistani coal-rich regions. More than 150 Department technicians are presently assigned to 30 nations to help in the development of natural resource programs.

To provide the energy production that is essential for advancing the economic status of underdeveloped countries, Bureau of Mines technicians have helped improve the utilization of native coal resources in several countries. In Afghanistan, for example, the Bureau's efforts have resulted in a new mine, using modern methods, which is now coming into production. Fuel shortages no longer will plague the country during severe winter months, and sizable quantities of coal will be available for the creation of small local industries in that land-locked nation. Similar achievements are being realized in Indonesia and Taiwan.

Bureau engineers have been successful in creating new industries in other free-world countries. In Mexico, a long dormant copper deposit has been brought to the verge of commercial operation through metallurgical research conducted by Government laboratories under the guidance of a Bureau metallurgist. In Korea, Bureau efforts to develop iron-ore resources have helped expand production, which now is supplying growing local needs and also providing a surplus for export.

Other Assignments

Our cooperation with nations abroad in resource conservation and development projects is by no means limited to the field of minerals. Recent assignments of Department experts include:

- A four-man Bureau of Reclamation team of engineers and agricultural experts will assist in evaluating proposals for water development in the Piranhas River Basin in northeastern Brazil, an area of extreme and persistent drought.

- In response to a request from the Inter-American Development Bank, the Bureau of Reclamation is providing the services of an engineer to advise on problems connected with the important Villamontes irrigation project in Bolivia.

- Seven engineers of the Geological Survey are conducting field surveys in Antarctica for topographic mapping in connection with the 1962-63 U.S. Antarctic research program.

In total, more than 150 Department technicians are presently assigned to 30 nations to help in the development of natural resource conservation programs. They are helping to solve water-control problems of the Blue Nile Basin in Ethiopia, assisting Pakistani geologists in a countrywide assessment of mineral and fuel resources, and encouraging the working of untapped resources in such widely separated countries as Thailand, Turkey, and Peru.

At the same time, hundreds of trainees from scores of foreign countries are studying in Department laboratories, pilot plants, and re-

search stations under the tutelage of Americans working to share their knowledge with fellow scientists from all parts of the globe.

Contributions by researchers of the Department's Bureau of Commercial Fisheries contributed importantly to the success of the FAO International Conference on Fish in Nutrition held in September 1961 in Washington, D.C., and attended by more than 300 scientists from 35 nations and international organizations.

Also, Bureau vessels and personnel will participate in the international cooperative investigations of the tropical Atlantic, a joint program of several nations concerned with an oceanographic study of the waters of the Atlantic Ocean between South America and Africa in 1963.

Conclusion

The world has undergone mighty changes since the days of the early conservationists. Enormous population gains and swift technological development have combined to create resource pressures which would have been totally inconceivable even a few decades ago. The two Roosevelts will live in history for their accomplishments in the field of conservation, but the bold new programs associated with their terms of office would be far from adequate to cope with the altered needs of today—or the multiplied needs of tomorrow.

In the past it was sufficient to concentrate on resource management, to curb waste and destruction. Today, while these elements of conservation remain essential, a vital new factor has been added—the need to apply the great discoveries of science to the task of “creating” new resources and enlarging the use of those existing.

There can be no question that scientific and social research must be the bedrock of our planning and action programs in the time ahead. Our investment in conservation research now will determine the environment in which our children will live, and the growth potential of the economy they inherit. The leaders of private industry are wisely making huge investments in research, but the responsibility for basic conservation research must fall heavily on government; first, because governments must consider a longer time span than individuals; and, second, because governments can best take account of the uncertainties of the future.

The Need for Knowledge

Research as a basis for planning and action is nowhere better illustrated than in the problem of water resources. We do not yet have adequate knowledge to be able to predict the effects of upstream



Increasing interest by young Americans in conservation education means trained scientists for the future.

developments in a river basin on downstream regulation and use; nor do we understand the long-term effects of flood control measures on the natural regime of streams and flood plains, or the behavior of ground water reservoirs.

To find the highest and best uses of known resources, we need better ways to combine the tools of economic projection and physical research.

It was for this reason—and to attune Departmental programs as rapidly as possible to the new age of scientific ascendancy in conservation—that the Department in 1961 announced appointment of a Science Advisor to the Secretary.

The Role of Young People

While giving increasing emphasis to scientific development, we must also keep in mind the fact that education is the key both to the techniques and the ethic of conservation. We must produce more young people with the skills needed for resource development, broad knowledge of the social, economic and technical factors that play upon each

other in this field, and the idealism and farsightedness that will give them a deep concern for the future.

Further, one of our most pressing needs is the establishment of a Youth Conservation Corps to conserve and develop the capacities of our two most precious national assets—our youth and our natural resources.

The Youth Conservation Corps, as supported by the Administration, would provide for agreements with Federal and State agencies for the use of Corps trainees in carrying out conservation programs of those agencies. It would provide employment on useful work that gives dignity to those performing it—and it would instill in our youth an appreciation of the natural world and an understanding of the land and our dependence upon it.

Substantial 2-Year Progress

Obviously, a great deal remains to be done in fulfilling our national conservation goals.

But the progress of the past 2 years has placed us well on our way toward a record of achievement unmatched since the Administrations of the two Roosevelts.

If current momentum is maintained—and it appears certain that it will be in the years immediately ahead—the Nation can feel a new confidence in the adequacy of natural resource supplies to meet the rapidly growing needs, both of today and tomorrow.

As President Kennedy has said, if we continue on our present course we can not only repay our debt to the past, but meet our obligations to the future.

Part II

*Annual Reports of the Bureaus and Offices
of the Department of the Interior*

Office of the Secretary of the Interior

Stewart L. Udall, *Secretary*

James K. Carr, *Under Secretary*

The Secretary of the Interior—as head of a major executive department of the Federal Government—serves as a member of the Cabinet of the President of the United States and the principal Federal executive officer charged with the administration of programs to conserve and to develop the natural resources of the United States.

The Secretary—assisted by the Under Secretary—directs and supervises the activities of the 24 bureaus and offices of the Department of the Interior. The Under Secretary, with the exception of certain matters requiring the personal attention of the Secretary, has the full authority of the Secretary on any matter which comes before him.

The responsibilities of the Secretary include:

- *Management* of some 553 million acres of public-domain lands and mineral leasing responsibilities for all other federally owned lands, as well as on the Federal areas off the coasts of our Nation.

- *Marketing* of electric power from plants with an installed capacity of about 12 million kilowatts, derived from federally constructed water, and flood, and navigational projects.

- *Providing* irrigation water for more than 8 million acres of agricultural lands in the arid and semiarid West which, for the most part, produce high-quality nonsurplus foods and fibers, worth \$1 billion annually.

- *Exercising* Federal trust responsibilities for about 350,000 Indians, working constantly to improve the natural and human resources of the Indians.

- *Administration*, economic improvement, social and political betterment in the remaining territorial areas of the United States—Guam, American Samoa, the Virgin Islands, and the United Nations-mandated Trust Territory of the Pacific.

— *Increasing* the mineral and fuel potentials of the Nation by assisting technically—and in the case of strategic minerals, financially—in developing and improving mining methods and geologic knowledge, and by promotion of conservation through wise utilization of our mineral and fuel resources.

— *Protecting* and administering almost 200 national parks, monuments, and historic sites, and creating new recreational areas at multipurpose water resource projects—as well as making public lands available for recreational needs to States and municipalities and providing planning aids to States. The various recreational lands and areas of the Department are visited by over 125 million Americans annually.

— *Promoting* the conservation and development of our vital sport and commercial fish populations and natural wildlife resources and protecting these resources from unnecessary depletion and selfish use.

— *Surveying* the water and mineral resources of the Nation with an eye to the future and providing for the basic geologic and topographic mapping of the Nation.

— *Directing* and coordinating the national effort to achieve the economical conversion of the waters of the oceans and brackish water into fresh water for human use.

In addition, the Secretary also exercises delegated defense mobilization responsibilities related to minerals, fuels, electric power, and commercial fisheries.

As the principal conservation agency of the Federal Government, the Department of the Interior is engaged in activities which daily affect the lives of all Americans. The term, "Interior," is actually a misnomer—for the Department should more properly be called the Department of Natural Resources.

Representatives of the Department are at work today around the globe. Employees are engaged in resource conservation activities in every State of the Nation, in our few remaining territorial areas, in the major oceans, at the north and south polar regions, and by invitation in more than a score of foreign countries. The Department has major responsibilities in the international field, particularly in foreign trade affecting minerals, fuels, and fishery products.

The Department receives annual appropriations from the Congress. The Department also returns substantial revenue to the Federal Treasury and to the States from its resource conservation activities.

In recent years, the appropriation of the Department for all purposes has been slightly under \$1 billion, and its income from resource conservation and development activities has been about 55 to 60 percent of its appropriations. The annual investment in resource

conservation by the Department continues to create new wealth and to generate new income each year throughout the Nation far beyond the cost of Federal expenditures.

In formulating and administering programs for the management, conservation and development of natural resources, the Department pursues the following objectives: The encouragement of efficient resource use; the assurance of adequately developed resources to meet the requirements of national defense and an expanding economy; the maintenance of productive resource capacity for future generations; the promotion of an equitable distribution of the benefits of publicly owned resources; the discouragement of wasteful exploitation; and the orderly incorporation of Indian groups into national life by providing equal educational and economic opportunity.

In the following pages, the programs of the Department during fiscal 1962 designed to meet these responsibilities and objectives are described.

Office of the Assistant Secretary

Public Land Management

John A. Carver, Jr., Assistant Secretary

The Public Land Management segment of the Department's operation enjoyed a unique experience during this fiscal year: the launching of a new Bureau to discharge responsibilities recently assumed by the Department. Within 90 days after the Outdoor Recreation Resources Review Commission submitted its long-awaited report, the Secretary implemented one of its key recommendations by creating the Bureau of Outdoor Recreation and appointing Dr. Edward Crafts to be its first Director.

In large measure, this significant event symbolizes the unique area of emphasis in land management activities during the year—a year which saw more progress toward catching up with the backlog of recreation land needs than in any similar period in this generation. The Cape Cod National Seashore became a legal reality and its basic organization was established early in the year; by year's end the Point Reyes and Padre Island National Seashores were on the threshold of Congressional approval, assured of the enactments which followed shortly. Large areas of the public domain were set aside for Federal-State cooperative development of wildlife resources. Economic surveys and other planning for Indian tribal land development placed heavy emphasis on recreation potential.

Notwithstanding this emphasis, other programs were moved forward at a gratifying pace. Substantial progress was made toward agreement with range users on increasing grazing fees to a level more commensurate with the value received. Provision has been made for equitable settlement with residential occupants of unpatented mining claims. Assistance to Indian groups has stimulated heightened interest in economic development of reservation resources. The rehabilitation of American Samoa progressed to the point where it served as a source of pride when the Territory played host to the South Pacific Commission Conference in July, 1962. New goals have

been established for education, health services and political development in the Trust Territory of the Pacific Islands and the Congress has more than doubled the authorized level of annual appropriations to achieve these objectives.

The maximum development of America's public land resources remains a stimulating challenge. The progress made in the past fiscal year offers new incentive to push forward to secure for the whole people the rich benefits which can flow from the wise use of this common inheritance.

Bureau of Indian Affairs

Philleo Nash, *Commissoner*



Early in the fiscal year 1962 the Bureau of Indian Affairs of the Department of the Interior was provided with a "roadmap" to guide its future operations in the form of a 77-page report submitted by the Secretary's Task Force on Indian Affairs. At the end of this "New Trail for American Indians" charted by the task force were three prime objectives: (1) Maximum Indian economic self-sufficiency, (2) full participation of Indians in American life, and (3) equal citizenship rights and responsibilities for Indians. To move toward the accomplishment of these goals, the task force report recommended less emphasis on the purely custodial functions of the Bureau, greater concentration of time, energy, and funds on fostering fuller development of both the human and natural resources on Indian reservations.

Viewed as a whole, fiscal 1962 was for the Bureau largely a period of reorganization, program planning, and "tooling up" for a heightening of development activity on the reservations. With two members of the task force (Philleo Nash and James E. Officer) joining the Bureau as Commissioner and Associate Commissioner in September, further momentum was given to these trends. In October, the Bureau brought together at Denver, Colo., all of its agency superintendents for the first nationwide meeting of these officials since 1938. Later in the year, an administrative reorganization was accomplished—not only in Washington but in area offices and agencies—combining in one new division all operating units directly concerned with economic development. Just before the close of the period a series of studies was launched by private research organizations working under contract (with funds provided by the Area Redevelopment Administration of the Department of Commerce) to determine the feasibility

of specific economic development enterprises on the Indian reservations and in the native villages of Alaska.

Agency Superintendents Meet at Denver

The meeting at Denver was especially important since it assembled under one roof the policymakers from Washington, the intermediate supervisors from the 10 area offices, and the agency superintendents with their direct responsibilities for translating policies and plans into tangible results on the reservations.

Discussion at the meeting was largely focused on the task force report and the steps necessary for effectuating its major recommendations. The Secretary of the Interior and the Assistant Secretary for Public Land Management as well as most of the top staff from the Bureau's Washington office actively participated in the conference.

Bureau Reorganized for Economic Development

Reorganization of the Bureau along economic development lines was discussed at the Denver conference and put fully into effect several months later. Under the plans that were finally worked out, all the resource functions of the Bureau (agricultural assistance, forestry, real estate appraisals, real property management, road construction and maintenance) were brought into closer relationship with the industrial development work and the revolving credit program within the structure of a new Division of Economic Development. In the Washington office the new Division also included a program planning staff and a specialist in housing.

In addition, a new position of Economic Adviser to the Commissioner (to work closely with but outside of the new Division) was created and filled during the year and plans were formulated for recruiting in fiscal 1963 a substantial number of economic development specialists with training in the social sciences for the staffs of agencies, area offices, and the Washington headquarters.

Feasibility Studies Launched

The studies undertaken with ARA funds in the latter part of the fiscal year embrace a wide range of potential economic developments to benefit Indians on reservations and Alaska natives.

Altogether 19 separate studies were initiated involving 15 reservations in 12 States as well as native villages of Alaska. Seven of the studies are focused on the possibilities of developing recreational facilities or tourist attractions as a source of employment and revenue for Indians; two are aimed at providing better inventories of timber resources; two are concerned with the development of mineral re-

sources; and others cover such diverse fields as the marketing of native arts and crafts produced in Alaska, the managerial skills of Indians on the Pyramid Lake Reservation in Nevada, and the feasibility of a food processing plant on the Colorado River Reservation in Arizona.

Progress Achieved on Other Fronts

Along with this overshadowing emphasis on economic development, many other activities of major importance took place during the year. The accelerated program of school construction, initiated in the spring of 1961 to eliminate unsafe and obsolete structures and provide sufficient classroom space for all Indian children needing education in Federal facilities as soon as possible, moved encouragingly forward.

Tribal operations officers were established at all area offices and many of the agencies to help tribes improve their political and business organizations along more up-to-date and efficiently functioning lines. A broad range of activities was undertaken in the educational field to improve English language capabilities of Indians pupils, to provide more intensive instruction in the arts for young Indians with capabilities and inclinations along this line, to upgrade further the quality of teaching in all Bureau schools, and to deal with widespread problems such as dropouts and lack of educational motivation. The scope of the Bureau's adult vocational training program was widened as a result of Congressional action increasing the appropriation authorization for the program from \$3.5 to \$7.5 million and appropriating an additional \$750,000 for use in fiscal 1962.

A fishery management specialist was added to the staff of the Bureau's area office at Portland to help Oregon and Washington tribes make more effective use of their commercial fish resources. In the final month of the fiscal year a three-man task force appointed by the Secretary visited Bureau installations in Alaska and consulted with people in the native villages on steps needed to improve Bureau operations in the far northern State.

Economic Development

The prime significance of the Bureau's action in establishing a new Division of Economic Development, headed by an Assistant Commissioner, is that it brings more sharply into focus all those activities of the Bureau that can contribute directly to the growth of a healthier and more dynamic economic climate on the reservations.

These include the programs of agricultural assistance (irrigation construction and maintenance, range management, and agricultural extension), the forestry work, activities connected with the leasing

of Indian lands for mineral development or surface use, the construction and maintenance of roads linking up remote Indian localities with major marketing centers or transportation arteries, the revolving credit program to supply the financial lifeblood (over and beyond that available from ordinary sources) needed for tribal and individual Indian economic enterprises, and the industrial development program to assist tribes in encouraging the establishment of private manufacturing plants in localities where they will provide tribal members with greater opportunities for year-round employment.

Comprehensive Planning Stressed

Because the potentialities for economic growth vary greatly from reservation to reservation—depending on the type and quantity of physical resources, the availability of manpower and skills, proximity to markets, and many other factors—comprehensive planning for each tribal jurisdiction is an essential first step in any orderly and fully effective program of economic advancement.

To give tribes greater technical help in this process, the Bureau formulated plans during the year to strengthen the planning liaison function at the agency level and to provide field specialists in various aspects of economic development in the fiscal year 1963.

Area Redevelopment Assistance

In fiscal 1962, considerable impetus was given to planning at the reservation level by the availability of loans and grants under the program of the Area Redevelopment Administration, Department of Commerce. Indian reservations are specifically mentioned as potentially eligible for assistance in the Area Redevelopment Act of May 1, 1961 and the Bureau has maintained close liaison with ARA since the beginning of its program.

During the past fiscal year, 51 reservation areas, encompassing 56 reservations and 4 native areas in Alaska, were designated "Reservation Redevelopment Areas" under the eligibility standards in the Area Redevelopment Act. Once this designation was made, the first step in moving to secure ARA assistance was the formulation of a preliminary overall economic development program (OEDP) for the designated area. With Bureau help, preliminary OEDP's were prepared for 27 of the reservation areas and submitted to ARA. Twenty of these were given provisional approval by ARA and the others were awaiting such approval at the close of the period. First steps were also taken on the preparation of comprehensive OEDP's which are required within one year after tentative approval of the preliminary documents.



To lay a solid factual basis for economic development enterprises on Indian reservations, 19 studies were launched in 1962 with funds supplied by the Area Redevelopment Administration. Seven of these were focused on the feasibility of tourist attractions like the excellent trout streams which have been developed by the White Mountain Apache recreational enterprise in Arizona.

The 19 studies to determine the economic feasibility of various types of economic developments were made possible by ARA technical assistance grants for contracts totaling \$718,343. Altogether 51 requests for such grants were submitted to ARA by the Bureau; the other 32 were still under consideration at the end of the year.

Navajo Irrigation Project Authorized

An important milestone on the road to greater economic growth for the Navajo Tribe of Arizona, New Mexico, and Utah was reached on June 13, 1962, when Presidential approval was given to a congressional act authorizing the Navajo Indian irrigation project. This culminated 15 years or more of activity on behalf of the project by both the Navajo Tribe and the Bureau of Indian Affairs.

Planned to provide irrigation for 110,630 acres of Navajo land in northwest New Mexico, the project will furnish an economic agri-



A major development of 1962 was the action of Congress in authorizing the 110,000-acre Navajo Indian irrigation project. The results that may be expected are depicted in these two photographs taken on the smaller Hogback project which has been under way on the Navajo Reservation for several years. The picture at top shows a Navajo family irrigating a Hogback project field. The bottom one depicts an excellent stand of alfalfa on another part of the project.

cultural base for 1,120 Navajo families and will create employment opportunities for 2,240 more in service and commercial enterprises made possible by the development. This means that as many as 17,000 individual Navajos, nearly one-fourth of the present reservation population, are in position to benefit directly after the project reaches the stage of full operation. The water supply for the project will come from the Navajo Reservoir on the San Juan River.

Outdoor Recreation Possibilities Studied

Stimulated by the outstanding success of the White Mountain Apache recreational enterprise on the Fort Apache Reservation in Arizona and other evidences of the economic potentialities of outdoor recreation development, many tribes throughout the country have taken an active and growing interest in establishing tourist attractions on their lands.

Under the ARA technical assistance grants, potentialities for recreational development are being studied on the Crow Creek and Lower Brule Reservations in South Dakota; the Warm Springs Reservation in Oregon; the Red Lake, Grand Portage, Nett Lake, Leech Lake, and White Earth Reservations in Minnesota; the Lac du Flambeau, Lac Courte Oreilles, Bad River, and Red Cliff Reservations in Wisconsin; the Pyramid Lake Reservation in Nevada; the Hopi Reservation in Arizona; the Nez Perce country in Idaho; the Colorado River Reservation in Arizona; and the Mescalero and Acoma Reservations in New Mexico.

On the Fort Berthold Reservation in North Dakota the tribal organization obtained a permit from the Army Corps of Engineers covering the Four Bears recreational area on the manmade lake created by Garrison Dam and is planning for commercial development through a long-term lease.

On the Jicarilla Apache Reservation in New Mexico, Dulce Lake was opened to the public for the first time on July 1, 1961. It offers excellent fishing opportunities and facilities suitable for anglers.

Game Conservation and Management

Fish and wildlife stocking programs are increasing the recreational potential on many reservations as well as providing a source of food for Indian people. The Bureau of Sport Fisheries and Wildlife provides technical advice and, through cooperative agreements with the tribes, furnishes fish to stock tribal waters. Relationships between the tribes and State game departments generally are improving and in many locations excellent cooperative relationships are enjoyed with better management and better hunting and fishing for Indians and non-Indians the result.



One hundred head of deer have been placed in the Tall Mountain area on the Navajo Indian Reservation. Twenty-five additional deer are soon to be released which will complete this wildlife project.

The problems associated with Indian treaty rights, particularly with respect to fishing in the Pacific Northwest, demand increased attention. The extent of the Indian treaty right to fish without regulation at traditional locations away from the reservations has never been decided by the courts to the complete satisfaction of either the Indians or the sports and commercial fishermen with whom they compete for a share of this resource. In assigning a fishery management specialist to the Portland office, the Bureau of Indian Affairs hopes to assist the Indians in developing programs for increasing the fish runs in the rivers which they control and in adopting conservation practices which will be acceptable to them and their neighbors and which, properly enforced, will help to lessen the tension between members of these two groups.

Forest Inventories

Up-to-date inventories of the volume of sawtimber have now been completed on more than 80 percent of the 5.5 million acres of commercially valuable Indian forests. All of the inventories so far completed have shown a much greater volume than the data previously available. As a result, it has been possible to increase the annual

timber harvest on many reservations without in any way sacrificing or compromising the underlying principles of sustained-yield management.

Under the ARA technical assistance grants, timber inventories were initiated on the Flathead, Blackfeet, and Rocky Boy's Reservations in Montana and the Wind River Reservation in Wyoming. Another inventory, using BIA funds, was started during the year on the Mescalero Reservation in New Mexico.

Timber Sales

Partly as a result of the recently completed inventories, the amount of timber cut from Indian lands in fiscal 1962 increased by 72 million board feet as compared with the previous year and totaled 546 million. The value of the total cut, however, decreased by about \$100,000 to approximately \$8 million and the average value per thousand board feet dropped \$2.41 to \$14.65. The decrease in average unit value was due partly to the unfavorable market in the forest products industry but more significantly to the cutting of less valuable species, which took place on many reservations as the harvest expanded toward the allowable annual cut.

Table A shows the relationship of Indian timber production to the lumber produced throughout the country during the past 10 calendar years. Because these data are on a calendar year basis, they differ somewhat from those shown above. The table does not include data from the Klamath Reservation in Oregon and the Menominee Reservation in Wisconsin where trust and other responsibilities of the Bureau have been brought to an end.

TABLE A—*Sale of Indian timber and lumber production in the United States*

Calendar year	Indian timber cut under contract				Lumber produced in the United States	
	Thousand board feet	Percent of 1952	Cash receipts	Percent of 1952	Million board feet	Percent of 1952
1952.....	467,641	100.0	5,941,636	100.0	37,462	100.0
1953.....	484,986	103.7	6,809,266	114.6	36,742	98.1
1954.....	456,185	97.6	6,788,667	114.3	36,356	97.0
1955.....	560,479	119.9	8,181,949	137.7	37,858	101.1
1956.....	487,445	104.2	9,269,392	156.0	38,629	103.1
1957.....	412,292	88.2	7,942,752	133.7	32,901	87.8
1958.....	467,376	99.9	8,540,100	143.7	33,385	89.1
1959.....	585,239	125.1	11,614,280	195.5	37,055	98.9
1960.....	517,742	110.7	10,287,928	173.1	34,737	92.7
1961.....	491,940	105.2	7,599,230	127.9	31,694	84.6

Tribal Forest Products Enterprises

The present mill on the Red Lake Reservation in Minnesota is obsolete and not properly designed to turn out forest products from the large supply of lower valued species available. The tribe and the Bureau have decided to replace the sawmill with a high-speed band mill which can economically handle the substantial volume of aspen, other hardwoods and jackpine remaining in the forest. The new sawmill should be in operation by next year.

The present Navajo sawmill produces 15 million board feet annually, but it, too, is becoming obsolete. The Navajo Tribal Council, with the help of several consultants and the Bureau of Indian Affairs, has decided to construct another mill with an annual capacity of 38 million board feet. Within a few years, production from the original mill will be discontinued. The new mill will employ an estimated 300 men in the plant and the woods.

On the Fort Apache Reservation in Arizona a planing mill has operated for many years. A sawmill was also operated until in recent years it was destroyed by fire. This function is now being ac-



An impressive sign of economic progress on Indian reservations is the new tribal sawmill on the New Mexico portion of the Navajo Reservation. It has an annual capacity of 38 million board feet.

complished through contract while the tribe continues to operate the planing mill. On the basis of an evident substantial increase of the allowable annual harvest of the tribal forest, and on the recommendation of an economic feasibility study, the tribe has begun to expand the enterprise. Loans have been obtained from the Bureau of Indian Affairs for a new sawmill. Construction has begun and production should begin in fiscal 1963.

In fiscal 1962 a logging enterprise was organized by the Blackfeet Indians. With Bureau cooperation, an agreement was executed between the tribal enterprise and the tribe for the purchase of reservation timber. The enterprise will harvest the timber and sell the logs to a private sawmill to be constructed.

Forest and Range Fires Increase

The 1961 fire season was severe throughout the West. Several large fires burned on three of the Indian reservations in Montana and Washington. During the season, the Bureau of Indian Affairs suppressed 1,629 fires, which burned 15,379 acres of timberland and 108,679 acres of range and other classes of lands. The total area burned was one-quarter of 1 percent of the Indian lands requiring protection. Over \$1 million was required to suppress these fires.

Real Estate Appraisal Work Given New Emphasis

One of the important moves involved in the reorganization of the Bureau for economic development was the creation of a new Branch of Real Estate Appraisals in the Division of Economic Development. Appraisal work was previously handled along with transactions activity by the former Branch of Realty. The decision to set it apart and seek funds for a larger staff of professional appraisers in the field was motivated by a realization that the rapidly changing patterns of land use over much of the West are increasingly affecting and impinging on Indian land holdings. In many cases it is known that Indian lands are bringing to tribal and individual owners much less than their full income-producing potential and in some localities profitable opportunities for development are being wholly overlooked. More extensive professional appraisal work should help greatly to correct these deficiencies.

One of the important functions of the new Branch is to prepare appraisal reports on lands being offered for lease or involved in other types of transactions. In fiscal 1962, such reports were prepared for about 9,000 individual land transactions and were needed for a total of 45,000.

A second major function of the Branch is the preparation of real estate planning reports which point out the highest and best use that

can be made of Indian real properties. About 20 such reports were completed during the year covering whole reservations or segments thereof. Expansion of this activity in the future should bring about important increases in the overall income from Indian lands and provide a more solid foundation for balanced programs of economic development on the reservations.

Mineral Development Activity

Two coal prospecting permits with option to lease were approved during the year on the Navajo Reservation in New Mexico. One covers in excess of 75,000 acres with option to lease as much as 25,000 acres. The other covers nearly 50,000 acres with option to lease areas containing 150,000,000 tons of coal reserves. Another similar permit was approved on the Hopi Reservation, Ariz., covering approximately 36,500 acres.

A 3-year mineral prospecting permit was approved on the Papago Reservation, Ariz. The permit grants an option to as many as 25 mining leases and covers all minerals except oil and gas. The permit covers approximately 4,335 square miles; all of the Papago Reservation except about 47,000 acres of tribal land that was advertised for competitive bidding at about the same time.

Leasing of Indian lands for oil and gas development brought in a total income of \$38,161,000 in bonuses, rents, and royalties. An additional income of \$3,171,000 was realized from leasing for other types of mineral development. The grand total from mineral leases and surface leasing for agricultural, business, residential, recreational, and other improvement purposes was approximately \$51.5 million.

The first sale of oil and gas leases on the lands of the Zuni Reservation in New Mexico was held during the year and brought in bonus offerings totaling over \$24,000.

Volume of Realty Transactions Grows

One significant measure of expanding economic activity on Indian reservations was the sharp increase in the number of requests or applications for transactions involving Indian land received by the Bureau during the year. Altogether, 76,040 requests for transactions of all types were received as compared with 65,255 in fiscal 1961. Trends in the economics of land use in the United States, and particularly on Indian reservations, suggest that the volume of transaction requests will continue increasing in future years.

A new title plant was established in the area office at Portland, Oreg., making this the fourth area provided with such facilities. Plans were formulated for setting up similar plants in the area offices at Phoenix, Ariz., and Anadarko, Okla., early in fiscal 1963.

During the year, a pilot project of consolidating fractional ownerships of tracts in "heirship" status into single ownerships of economically useful size through an extensive program of exchanges was initiated on the Pine Ridge Reservation in South Dakota. If the procedure proves effective and useful, it will have wide applicability on other reservations.

Under a congressional act of September 14, 1961, nearly 70,000 acres of public-domain lands were transferred to eight of the New Mexico Indian pueblos. The transferred lands were intermingled with other pueblo holdings and have presented troublesome management problems for many years.

Credit—A Necessary Tool

Adequate financing is a prerequisite of any program for economic development of Indians. While total financing has increased from about \$43 million to \$108 million during the past 10 years, available funds continue to lag behind need.

Of recent years, banks and other lending institutions serving citizens generally have become increasingly conscious that Indian well-being is vital to the well-being of the total area; that Indian resources, both human and physical, are underdeveloped and underutilized; that Indians are entitled to the same assistance as other citizens; and that they present an opportunity for increased business and profit. Over the past 10 years, the amount of financing furnished Indians from such sources has increased from an estimated \$20 million to over \$75 million.

One factor which has undoubtedly helped to account for this increase has been action by certain tribal groups such as the Shoshone of Wyoming and the Mescalero Apaches of New Mexico in entering into guaranty agreements covering bank loans made to tribal members who qualify in every way except for adequate security. Along the same line, the Blackfeet Tribe of Montana has posted a \$50,000 guaranty fund which enables a local production credit association to make loans to tribal members who could not qualify under its customary procedures. The association had nearly \$110,000 outstanding in loans under this agreement at the end of the fiscal year.

Federal Revolving Fund and Tribal Financing

Two main funds are used in financing Indians through the Bureau. If a tribe has available money of its own, it is required to use its funds before a loan by the United States is approved. A total of \$22.2 million of tribal funds was being used at the close of the fiscal year.

The second source is a revolving fund for loans authorized by the Congress. At the close of the fiscal year, loans from the fund totaling about \$10.4 million were outstanding.

During the year, the authorization for the revolving fund was increased by the Congress from \$17 to \$27 million. An additional \$4 million was appropriated, bringing the total to \$17,799,600.

Due to its revolving nature, loans totaling over \$38 million have been made from the Federal revolving fund, of which \$27.5 million has been repaid and \$187 thousand cancelled.

Commitments for additional loans totaling \$6.4 million were made during 1961 compared with \$3.2 million in 1960. Applications totaling nearly \$12 million had either been approved or authorized subject to the availability of funds at the close of the fiscal year. These applications are mainly for relending operations; however, nearly one-half of the amount is for tribal enterprises and loans to attract industries to operate on or near reservations. Requests in various stages were pending for almost an additional \$40 million.

Better Housing Planned for Indians

Provision of adequate housing has been recognized universally as a basic essential to effectuating improvement in social outlook and economic betterment of a group of people. Bureau efforts to accelerate improvements in the notoriously substandard housing of Indians have been directed toward opening up Indian reservations to the financial assistance already available through Federal housing agencies to non-reservation areas. Progress along this line has involved accommodation on the part of all agencies and institutions concerned to the system of land tenure which is characteristic of Indian landholdings.

A comprehensive memorandum of understanding was executed in fiscal 1962 between the Bureau and the Federal Housing Administration which will provide mortgage insurance on leasehold estates on Indian trust lands. Negotiations were also initiated with the Federal National Mortgage Association for the establishment of a special fund for the purchase of insured mortgages on leasehold estates on Indian trust lands.

In the public housing field significant advances were made following a determination by the Public Housing Administration that tribal groups can participate in the benefits of its low-rent housing program if they are recognized as governmental entities and projects are located on tribal lands.

In line with this determination a number of tribes adopted ordinances establishing local housing authorities. On the Pine Ridge Reservation in South Dakota a contributions contract was executed between PHA and the Oglala Sioux Housing Authority in the amount



On the Fort Apache Reservation in Arizona eight families joined forces during 1962 in a "self-help" housing venture which is being closely studied by the Bureau of Indian Affairs as a key to wider action on other reservations. The picture at the top shows the type of housing being replaced, while the photo at the bottom depicts one of the homes constructed under the venture. Financing was provided from the tribal loan fund and the labor was furnished by the families working together. Technical guidance was supplied by a carpenter on the tribal payroll.

of \$1,120,232. It provides for the construction of 88 low-rent units including 23 for housing elderly members of the tribe. The Standing Rock Sioux Housing Authority has entered into a similar contract in the amount of \$1,664,082 for the construction of 100 similar units.

Both of these developments are located near established industries and will afford better living standards for Indian families employed in the plants. Many of the other tribes are planning to locate their housing projects close to potential industrial sites.

In the latter part of the year the White Mountain Apache Tribe of Arizona started a pilot self-help housing project with eight tribal families participating in the program. Tribal loans were made to these families for the purchase of materials. A cooperating agreement was executed by the participants who did all the construction with the assistance of a construction supervisor furnished by the tribe.

The Bureau is exploring the possibility of systematically encouraging and assisting similar self-help housing programs on other reservations throughout the country.

Industrial Payroll Gains

During the year, three industrial plants were completed and one expanded in reservation areas. When in full operation, they will provide approximately 860 jobs. To date, 20 industrial plants have been established on or near Indian reservations as a result of the coordinated efforts of Indian tribes, local communities, other Government agencies, and representatives of the Bureau. When in full operation, it is anticipated that the plants will provide about 3,200 jobs, approximately 70 percent of which will be filled by Indian workers.

At Chandler, Ariz., Harry Winston, Inc., internationally famous diamond merchants of New York City, started operating in May 1962 their new plant which has 40 Indian employees and plans to take on 30 new Indian trainees per month until a work force of approximately 200 is reached.

The Shelton Basket Corp., a cooperative venture of the Lac Courte Oreilles Band of Lake Superior Chippewas and the community of Hayward, Wis., expanded its operations by establishing an ammunition box division in the spring of 1962 in order to carry out a supply contract with the Department of Defense. This was believed to be the first contract ever awarded by a Government agency to a corporation controlled by American Indians. Including the new division, the company employs 108 workers, 77 of whom are Indians.

Another example of cooperative industrial development activity was in eastern Oklahoma where the Seminole Tribe and the community of Wewoka got together not only in financing a locally owned company



Further progress was made during 1962 in the development of private industries that furnish year-round employment for Indian people on reservations. A fishing tackle plant on the Pine Ridge Reservation in South Dakota, when in full operation, has a payroll of 380 workers.



Another major industrial development was the establishment of a diamond processing plant at Chandler, Ariz., which began operations in May 1962. It furnishes jobs to many Indians from nearby reservations and will eventually have a payroll of about 200 workers.

but in its management through joint representation on the board of directors. The company is known as Plasteck Central, Inc., and was formed by the citizens of Wewoka for the primary purpose of purchasing a plastics manufacturing firm and establishing the operations in Wewoka. The plant produces aircraft cockpit illuminating control panels for military and defense contractors, and will make panels for automobiles, computers, and other uses. Production started in November 1961, and the plant is now employing 20 workers, 10 of whom are Indians.

A result of the cooperative liaison activities of representatives for the Small Business Administration, the Ashland Industrial Development Corp., Wisconsin, and the Bureau of Indian Affairs is the location of the Swiss Precision Manufacturing Division plant in Ashland by the Rainier Co., Inc., of New York City, to make precision gears and related items. Operations started in June 1962 with approximately 30 workers, 13 of whom are Indians. The company anticipates that they will employ between 150 and 200 workers when in full opera-

tion. The Bad River and Red Cliff Bands of Chippewas will benefit, primarily, from opportunities for Indian employment opened at this plant.

Training in Conservation and Farming

Youth conservation camps are becoming very popular on Indian reservations. The camps first started because tribal officials found a need for healthful recreation and education in the conservation and development of natural resources to occupy the youth during the summer months. The youngsters get instruction and demonstrations in the conservation and development of natural resources and are instructed in health, recreation, safety, and other activities. Technicians of the Bureau of Indian Affairs work with the tribes in these camps and furnish instruction.

In fiscal 1962, personnel from the Bureau's Branch of Land Operations, county agents, and land-grant college extension service specialists participated in more than 10,000 meetings held in carrying out extension work with Indians. In addition to group meetings, emphasis was placed on working with individual Indian families through farm and home calls by extension agents to stimulate interest in community activities, improved livestock and crop production, and home management practices.

During the year there were approximately 10,000 Indian boys and girls throughout the country participating in 4-H Club activities. Many received county and statewide recognition for their achievements in project completions and in giving demonstrations.

Range Management

Indian tribal leaders as well as Indian ranchers and landowners throughout the country are showing increased interest in their range land, its use and management. Bureau emphasis on reservation economic development planning and range or ranch unit planning and development, coupled with a growing awareness of the economic facts of livestock production, brought this about. Basic to range use planning is an inventory of the physical resource. The inventory of Indian rangeland, initiated by the Bureau in 1957, has been progressing at the rate of approximately 3.75 million acres a year. Work has now been completed on about half of the 42 million acres to be surveyed.

Indian use of the range resource is increasing and 86 percent of it is currently being used by Indian operators. The livestock industry is of major importance to Indian people and every effort is made to promote better livestock and range management to increase the economic return to the operators. One result of these efforts is exempli-

fied by the Papago tribal herd range in Arizona. The Papagos have adopted a supplementary feeding program resulting in a marked increase in the calf crop and weight of livestock sold. It also enables better use to be made of the range resource.



The range conservationist and Indian livestock operators cooperatively plan for proper range use on the Blackfeet Reservation in Montana.

Improvement of Roads Continues

One factor which has operated for many years to retard full economic and social development on Indian reservations has been the lack of adequate road facilities.

The Bureau's program of road construction and maintenance, which began in 1933, produced many helpful improvements over the years but was so late in getting started and so meagerly financed for a long time that it fell far short of meeting the needs. In recent years, however, appropriations for this work have been much more generous and striking progress has been achieved in many areas.

In fiscal 1962 nearly 400 miles of Bureau roads were black-topped and the cumulative effects of work done in earlier years became increasingly apparent. These effects were noticeable in the larger number of Indians driving late model pickups or shopping in supermarkets and in the growing number of industrial concerns which were finding it possible to operate in previously isolated reservation areas.

These tangible evidences of progress in fiscal 1962 held promise for better school attendance and other manifestations of economic and social advancement on reservations in the years ahead.

Education

To a greater extent than many people realize, the Bureau of Indian Affairs is today, and has been for many years, basically, an education agency. Funds spent for the operation of its extensive school system both on and off reservations together with construction appropriations used for building or rehabilitating various types of school-connected facilities account, in total, for more than 60 percent of the Bureau's budget. Involvement of Bureau personnel is in a similar ratio. And even some of the Bureau's more technical programs, such as forestry and agricultural assistance, are largely educational in nature.

The fiscal year 1962 was an unusually active one in Indian education and brought significant advances on many fronts.

Encouraging Progress in School Construction

Despite the impressively large amount of Indian school construction accomplished over the 8-year period beginning in 1953, there were still nearly 9,000 Indian children from 6 through 18 years of age out of school in the spring of 1961 and almost 5,000 of these were not enrolled because of a lack of classroom space. This problem of insufficient space was centered chiefly on the Navajo Reservation in Arizona, New Mexico, and Utah; in the native communities of Alaska; and on the Choctaw Reservation in Mississippi.

In addition, many of the Bureau's schools were badly overcrowded; many, built shortly before or after the turn of the present century, were seriously obsolete; many had structural or other deficiencies that made them unsafe or insanitary for further continued use.

Through an accelerated program of school construction, launched in the spring of 1961, the Bureau aims to accomplish three prime objectives over a period of approximately 4 fiscal years: (1) Elimination of the most serious overcrowding in Federal Indian school facilities; (2) correction or elimination of the deficiencies that represent health or safety hazards; and (3) construction of enough additional classrooms and related facilities to accommodate all Indian children needing education under Bureau auspices. Since the number of Indian children in the school-age bracket grows larger every year, the total capacity of the system will obviously have to be increased by considerably more than 5,000 seats in order to achieve the third of these objectives.

In fiscal 1962 the Bureau completed 18 school construction projects, adding 675 classroom seats to the capacity of its system, and initiated 40 more projects which will eventually accommodate an additional 2,786 Indian students. It was an encouraging record for the first full fiscal year under the accelerated program.



Under an accelerated program of school construction the Bureau of Indian Affairs in 1962 completed 18 projects providing classroom space for 675 additional pupils and initiated 40 projects that will eventually make room for 2,786 Indian students. The classroom building shown above is part of the project completed at the Teec Nos Pos School on the Navajo Reservation.

Among the more important of the completed projects were one adding 249 seats at the Teec Nos Pos School on the Navajo Reservation in Arizona, another adding 120 seats at the Dunseith School on the Turtle Mountain Reservation in North Dakota, and a third contributing 102 additional seats at the Busby School on the Northern Cheyenne Reservation in Montana.

Outstanding projects initiated but not completed during the year included construction of a wholly new facility with 630 classroom seats on the Navajo Reservation at Tuba City, Ariz., and expansion of existing facilities at 7 other locations on the Navajo Reservation. These latter projects will add 212 seats at the Shonto School, 188 at the Dilcon School, 147 at the Dennehotso School, and 118 at the Hunter's Point School, all on the Arizona portion of the reservation, and 150 seats at the Crownpoint School, 150 at the Pueblo Pintado School, and 136 at the Tohatchi School in the New Mexico reservation area.

School Construction Standards Improved

During the year education and construction personnel of the Bureau jointly evaluated standards for school construction in the light of changing educational needs. The standards formerly in use designed principally for elementary children, were revised and new standards were established for the construction of facilities for high school students and dormitories for older children. These new standards will provide more adequate facilities for urgently needed libraries and laboratory classes in science courses; and the dormitories will of themselves increase learning opportunities for Indian children who come mainly from economically disadvantaged homes. The approved standards represent a very important step toward education of better quality for Indian children.



For many years the Bureau of Indian Affairs has stressed English language teaching in its schools. Today it is conducting research in modern "language laboratory" techniques to speed up the process.

English Language Teaching Highlighted

Emphasis on the teaching of English as a second language continued throughout Bureau schools during fiscal 1962. Several articles were

published in Indian Education, a semimonthly publication addressed to all Bureau education personnel, to clarify (1) the present status of this subject in Bureau schools, (2) the fundamental principles underlying the teaching of language, (3) goals that must be achieved if learning English as a second language is effective, and (4) techniques indicated if the goals and principles are to be realized.

The Intermountain School at Brigham, Utah, began a research project on the use of the language laboratory to assist Indian pupils in speaking correct English. This laboratory and the series of films, "Let's Learn English," developed by the U.S. Information Agency, were introduced to education supervisory personnel at a Bureau-wide workshop. Plans were made for additional research on the best uses that Bureau schools can make of the laboratory and films to improve the learning of English as a second language.

Experiments were carried on in the Albuquerque and Shiprock schools in adapting special techniques of teaching English as a second language. The Navajo Agency orientation workshop carried on successful projects which assisted new teachers to understand quickly the problems of non-English speaking pupils who are beginning in functional situations to learn English as a second language.

Summer Activities Grow in Importance

The summer programs which the Bureau initiated on a trial basis for students in its schools during the vacation months of 1960 were continued and expanded in 1961. Total enrollment rose from 2,200 to 7,246.

The four main categories of these programs were recreation, academic instruction, student employment, and field trips. The main features of the recreation program were sports and games. The academic programs emphasized remedial work in the skill subjects with special attention given to oral and written English. Pupils who had special learning problems during the regular term were given an opportunity to catch up during the summer months. The program of summer employment for students answered one of the most important needs of teenagers—the opportunity to earn money through their own efforts. The field trips provided under the summer program were designed to broaden the Indian child's horizon by giving him many and varied experiences beyond the restricted scope of his life on the reservation. Indian youngsters were given the opportunity to leave their reservation areas, some for the first time, and participate in activities that are taken for granted by non-Indian youngsters.

An evaluation of the 1961 program revealed a number of benefits. Juvenile delinquency was substantially reduced in locations where summer programs were in operation. Academic gains were made

during the summer months. Students were given opportunities to make money, and the background of a number of students was enriched through field trips. One of the most important results of the program is that a large percentage of the participants returned to school.

Institute of American Indian Arts

In August 1961, the Bureau announced plans for converting the Santa Fe Indian School into the Institute of American Indian Arts. The institute will enroll Indian students from all federally recognized tribes throughout the country and is planned as an accredited senior high school with instruction in the usual academic subjects. In addition, the curriculum will cover broad as well as specialized training in the creative arts, and will prepare the student for vocational opportunities in applied arts and related work.

During fiscal 1962, contracts were let for the construction and conversion of buildings to be completed before the institute opens. The organization and staffing of the school have progressed to the point where a definite date of October 1, 1962, has been set for the opening.

Concho Demonstration School

Two dormitories at the Concho School in Oklahoma have been converted to the Concho Demonstration School. These dormitories will provide living accommodations, classrooms, and recreation facilities for the educational rehabilitation of approximately 48 students who have dropped out of school or have demonstrated low educational motivation. The school will serve as a demonstration laboratory for in-service training of guidance and teaching personnel who need help in developing skills and programs in working more effectively with students who are potential dropouts or in need of educational motivation. Students will be accepted for enrollment in September 1962.

The Master Teacher Program

Special attention was given to a program for reemphasizing high-quality teaching and for recognizing the superior teacher through promotion to a GS-9 position. Guidelines and criteria for developing superior teaching, set up previously by representative committees of education personnel from all areas, were distributed for the reaction and assistance of teachers, supervisors, education specialists, and administrators in all areas. Meetings for this purpose were attended by a very large percent of all Bureau teaching personnel. Content for the 1962 Bureau-wide education workshop originated in these meetings.

This workshop, held in June, dealt with the improvement of supervisory skills of all personnel in the education program. The 200 participants contributed materially to its success, and furthered the possibility of putting into effect in the near future the master teacher program and the upgrading of teaching and supervision throughout the school staff.

Story of Special Navajo Program Published To Aid Educators

An account of the origin, development, and accomplishments of the special program in the education of teenage illiterates of the Navajo Tribe was published during 1962. The purposes to be served by the written account are (1) to make a record of this education program which has served several thousand young Indian people for the past 15 years; and (2) to share with interested educators, and with communities everywhere, the experiences of Bureau education personnel in dealing with a serious and urgent problem of undereducation of teenagers and young adults.

It is expected that this story will have meaning for people in widely scattered parts of the world because it contains principles and guidelines that are central to any sound education program, particularly one that is attempting to meet the needs of an eager but educationally handicapped group of young people.

Indian Participation in Education Programs

Interest and support of the education program by Indian parents and tribal officials continued to increase. A survey made in the spring of 1962 revealed wide participation by Indians in school management and planning groups such as parent-teacher associations, school boards, and school committees. The survey showed that there are at least 414 PTA groups in which Indian members participate. In addition, 284 school boards have a total of 367 Indian members. There are 12 Indian members of Indian commissions and a total of 1,214 Indian members of booster and other community organizations. There is evidence that such participation is greater than indicated by the survey since responses were not received from every school group.

The Fifth Annual Conference on Navajo Education, planned and directed by the Navajo Tribal Education Committee, brought together large numbers of Bureau education officials, public school and mission school officials, and Navajo tribal officials. The conference dealt with the status of education of Navajo children and youth, and with the direction which education should take in the next several years.

Following the meeting a planning conference was held involving administrators and specialists concerned with schools enrolling older Navajo students. At this time goals for the education programs were reexamined and redefined, and plans were made to begin study and revision of the curriculum guides used in these schools.

Work with Colleges

A 3-week workshop, "Trends in Indian Education," was conducted in 1962 for the benefit of public school teachers who teach considerable numbers of Indian children. This workshop, held under the auspices of the Eastern Montana College of Education, took place on the college campus. Serving as workshop resource persons were personnel from the Bureau's education staff, the Director of Indian Education from the Montana State Education Department, a Crow Tribal Council member and local school board members, and a public school principal. Twenty-six public school teachers completed the workshop course, earning from 3 to 5 hours of college credit. Excerpts from their writings in the course were used in *Indian Education* articles.



Many Indian adults seek an education and want to learn so that they may take their place in the mainstream of American life. This class, at Twin Lakes, N. Mex., on the Navajo Reservation, was typical of those conducted by the Bureau of Indian Affairs in communities during 1962.

Adult Education

Many Indian people are at a disadvantage in their communities by not having attained sufficient language, social or economic skills to permit them to be self-sufficient in modern living. For the benefit of educationally disadvantaged adult Indians who can qualify for such services, the Bureau conducts special education programs where the need and desire are indicated.

Adult education teaching units have been established upon the request and with the concurrence of the tribal governing bodies at 27 agencies and locations throughout the United States. These teaching units are now serving approximately 127 Indian communities, and offer a wide variety of instruction. Over the past 6 or 7 years approximately 6,700 adult Indians have been participants in formal and informal learning activities under this program. Of this number, 51 completed the required courses for equivalent high school graduation.

Higher Education

The Bureau continued its work of encouraging and promoting the enrollment of qualified Indian students in courses of higher education. This is effected through the guidance programs in Bureau schools, through close cooperation with public and mission schools, and through coordinating Federal grant, loan, and working scholarship programs with scholarship aid programs of State and tribal group organizations and with other non-Federal organizations and institutions.

Over 4,500 Indian students were enrolled in schools above the high school level in 1962; approximately 2,900 of these were enrolled in college courses leading to a degree.

Enrollment Continues to Rise

Enrollment of Indian children of school age increased 4 percent in fiscal 1962 as compared to the preceding year. Of the 117,562 enrolled, 59.2 percent attended public schools, 33.1 percent were in Federal schools, and 7.7 percent were in mission and other private schools.

The Bureau of Indian Affairs in fiscal 1962 operated 263 schools with an enrollment of 42,045 including those under 6 and over 18 years of age. In addition, dormitory facilities were provided at 20 locations for students who attended public schools. Dormitory operations of this type are used to meet unusual emergency needs and do not reflect a permanent pattern for educating Indians.

The long-range objective of the Indian education program calls for the eventual enrollment of all Indian children in public schools. In a number of States this objective has been reached. In other States

having large Indian populations the number going into the public schools increases annually. During 1962 public school enrollment increased by 4,664 students. Since the fiscal year 1960, Bureau reports have not included the number of Indian children enrolled in public schools in California, Idaho, Michigan, Minnesota, Nebraska, Oregon, Texas, Washington, and Wisconsin, where responsibility for their education has been accepted by the States, and Federal schools for State residents are no longer operated.

Tribal Operations

In the vital field of tribal planning to promote the general welfare of tribal members, significant advances were made during the year by the leadership of the Nez Perce Tribe of Idaho, the Omaha Tribe of Nebraska, and the Standing Rock Sioux Tribe of North and South Dakota.

An act of April 24, 1961 (75 Stat. 45), provided that the \$7,157,-605.06 awarded the Nez Perce by the Indian Claims Commission could be used as the tribe's governing body saw fit after approval by the Secretary of the Interior. Last September, the Secretary approved a program for use of the judgment funds providing for a per capita payment of \$750 to each of the 2,064 tribal members with the remainder of approximately \$4,024,195 to be programmed for reservation development. Currently, a committee composed of leading business and professional men in the area, as well as tribal leaders, is working closely with Bureau representatives to determine the best plan for providing lasting benefits for all tribal members.

The Omaha Tribe of Nebraska has formulated an energetic development program. It was approved by the Secretary of the Interior and details for each phase of the program were being worked out by tribal leaders at the end of the reporting period. Bureau members are assisting the tribe in furthering its aims and encouraging modification of organizational documents to permit the tribe to better avail itself of facilities offered by other Government agencies. The program includes plans for land purchase and a tribal scholarship grant program, development loans to individuals, and a plan for the formulation of the tribe's overall economic development. The act of September 14, 1961 (75 Stat. 508), authorized the Secretary to prepare a membership roll to serve as a basis for the distribution of the \$2,900,000 judgment awarded the tribe. A per capita payment of \$750 has been approved and approximately \$1,200,000 of the award is currently earmarked for the development program. About 2,500 Indians will be involved.

The Standing Rock Sioux Tribe of North and South Dakota is also realizing continuing gains from its \$9 million rehabilitation program made possible by settlements under the act of September 2, 1958 (72 Stat. 1762). The major portion of the family plan phase of this program (described in some detail in the 1960 annual report) has been completed. In fiscal 1962 the tribe completed construction of a tribally operated bowling alley and a greatly needed administration building.

Bureau Helps Tribes to Improve Organizations

Essential for tribal development is improving tribal organization. In fiscal 1962 the Bureau broadened and intensified its activities to provide tribes with technical aid in bringing about such improvements.

An outstanding development was the organization of the Miccosukee Tribe of Florida under the Indian Reorganization Act of June 18, 1934 (48 Stat. 984). At an election held December 17, 1961, the proposed constitution and bylaws of the Miccosukee were adopted and the Secretary of the Interior approved the document on January 11, 1962. A major barrier to improving the lot of the 102 individuals on the Miccosukee roll was thus removed.

The updating of constitutions by amendment to permit more effective tribal operation continued. The Devils Lake Sioux in North Dakota began functioning under a revised constitution and bylaws and in June approval was given to amendments of the constitution and bylaws of the Rosebud Sioux Tribe of South Dakota. The changes at Rosebud will permit the tribe to take greater advantage of services of other Government agencies. The Florida Seminoles changed in its entirety the article of their constitution dealing with enrollment.

The Bureau, to provide tribes with greater assistance in achieving more effective government, appointed during the year for the first time area tribal operations officers who will devote their time to working with tribal groups within their area on all questions of tribal operation.

A special task force visited many of the native villages throughout Alaska during June and gathered material to add to the Task Force Report on Indian Affairs made to the Secretary on July 10, 1961, covering Indian areas in other parts of the United States. Associate Commissioner James E. Officer represented the Bureau of Indian Affairs. Prior to the task force visit, the Bureau assigned a tribal operations officer to the Juneau area office to help the native communities develop appropriate organizations for the management of their economic affairs.

Activities Under Termination Laws

Although Department of the Interior responsibility for several tribes was officially terminated during the reported year under the provisions of laws enacted in the 1950's, the Bureau continued a friendly interest in the success of these tribes and their members in their new era of self-government and self-management as citizens of their respective States.

Revocation of the Federal constitution and bylaws of the Catawba Tribe of South Carolina on July 1, 1962, by the Secretary (under authority of the act of September 21, 1959) marked the end of the relationship that existed between the tribe and the Government. Before this termination action the Bureau made a final roll of the Catawbas and each of the 631 members received his or her share of the tribal assets valued at \$186,774.40. Some 369 members took their share in land (1,800 acres), and 262 members chose instead money obtained from the sale of unselected land (1,400 acres). The State of South Carolina still holds in trust for the Catawbas a 640-acre tract known as the Old Reservation.

Termination notices were published during the reporting year for 7 of the 41 California rancherias named in the act of August 18, 1958 (72 Stat. 619), after the assets on each rancheria were given to the Indians in accordance with a previously approved distribution plan. Seven rancherias had previously been terminated. The provisions of the plans of 24 more rancherias are being worked out as a major project in California. The title insurance companies in that State are questioning the insurability of titles given to the Indians under the act, and the issuance of deeds by the area director has been halted until this question is resolved. The Public Health Service is canvassing the rancherias under termination to ascertain on which rancherias it can install water and/or sewerage facilities under Public Law 86-121 before termination takes place.

Federal supervision over the affairs of the Klamath Indians of Oregon came to an end August 13, 1961. The Klamath Termination Act of August 13, 1954 (68 Stat. 718), permitted members who so desired to withdraw their share of tribal property in cash and to carry on as independent citizens. Tribesmen could also choose to maintain common ownership of their shares of tribal property under State instead of Federal law. Withdrawal was favored by 1,660, or 77 percent of the enrolled members. A total of 473 chose to remain as a group and received about 145,000 acres which is managed for their benefit by a Portland bank. A sum of \$43,241.90 was paid to each of those withdrawing, for the majority of whom, being minors, individual trust funds were established.

Federal supervision over 490 "mixed-blood" members of the Ute Tribe of the Uintah and Ouray Reservation in Utah ended August

27, 1961, pursuant to the act of August 27, 1954 (68 Stat. 877), as amended. The "mixed-bloods" have organized themselves as the Affiliated Ute Citizens of the State of Utah and have established three corporations to administer land, claims, and other property held among them in common. Those owning individual allotments of trust land were given patents in fee.

Unresolved Problems

Also during the reporting year, the Bureau sponsored legislation to effect the termination of Federal responsibility over the Indians of the Ponca Tribe of Nebraska. This legislation was introduced at the request of some of the tribal members and, if enacted, will not take effect until it is approved by a majority vote of the tribal membership.

Despite the gains made in the area of tribal operations, many issues continue to confront the Bureau. Finding even partial solutions will prove difficult. A way must be found to end the dispute among the leaders of the Kiowa, Comanche, and Apache Tribes in Oklahoma which has virtually removed the possibility of effective tribal government. The Crows of Montana are faced with the problem of revising their constitution to provide for more stable government to enable the programming of a \$10,242,984 judgment awarded them in May 1961. The Pine Ridge Sioux also are confronted with the need to update their constitution. The ramifications stemming from the submission of a two-step termination plan by the Colville Tribes of Washington State will cause several thorny problems.

Many complications are expected to develop in ascertaining the beneficiaries of a large number of claims awards made, or about to be made, to small Indian tribes throughout the Pacific Northwest, some of which are unorganized and whose members are widely dispersed. Similar problems are likely to arise in connection with distributing the Cherokee claims award of more than \$14 million. During the fiscal year, legislation was introduced to divide this money among the individuals listed on the final Cherokee roll of 1907 and heirs of deceased enrollees. In the case of many tribes, the claims awards have provided the first large sums of money ever available for group and individual development and helping some of them with organizing in such a way as to make the best use of these sums is certain to occupy a major share of the time of the Bureau's tribal operations staff in the months and years ahead.

Employment Assistance

The name of the program formerly known as Relocation Services was formally changed in fiscal 1962 to "Employment Assistance."

The new title was considered more descriptive of the many facets of individualized economic and social service provided under the program.

Over the years the Bureau has consistently broadened the scope of this program and refined its coverage in line with the practical demands of attempting to best serve the Indian. During fiscal 1962, in addition to the regular program of service for direct employment, vocational training of adults in selected and approved institutions, and on-the-job training in industrial plants in both within State and out-of-State (metropolitan urban) situations, several types of special "employment assistance" services were provided to interested and eligible applicants.

Special Aid for Catawba Indians

On the Catawba Reservation in South Carolina, where Bureau services were scheduled to end July 1, 1962, a census of needs was made during the fiscal year and funds were obligated to provide



In addition to the vocational trainees, many Indians moved to urban communities with Bureau help in 1962 for direct employment. This home in San Jose, Calif., is owned by an Indian from Concho, Okla., who relocated in 1957 and now earns \$11,000 a year as a tool checker in a nearby industrial plant.

special vocational training for 39 adult members of the tribe. These funds were used for developing vocational skills at approved training institutions regardless of where the Catawba tribal members lived and wherever they chose to remain for employment.

Refinement of Screening Process

To make its training activities more closely responsive to the changing demands of American industry for workers with special skills, the Bureau has conducted intensive research and negotiated with a large number of employers throughout the country. This has resulted in improved and much more sensitive screening of applicants for employment assistance and more effective service to the Indians who enter training. As one example, it has been found that a specially planned short course of 24 weeks in electronics will qualify graduates for remunerative jobs now available throughout the United States.

On-the-Job Training Activities

With the increasing development of interest in location of industrial plants on and near the reservations, the Employment Assistance staff has worked in close conjunction with other Bureau officials and industrial management in (1) screening and recommending eligible applicants for on-the-job training; (2) providing followup services to workers and their families in orienting them to basic demands of steady employment; and (3) helping the trainees adapt to life in the community, make wise use of wages to meet practical needs of the family unit, and develop pride in the responsibilities of citizenship and economic independence. The measure of the success of this type of joint service to the on-the-job trainee has been evidenced by a decrease in law-and-order problems, improved school attendance, better nourished and better dressed citizens, some housing improvements and a noticeable awareness of living space and home furnishing standards, and generally improved acceptance by merchants in nearby communities. Outstanding results along this line were achieved during the year among workers in training at Pine Ridge and McLaughlin, S. Dak., Cherokee, N.C., and Hayward, Wis.

More Aid From ARA

Under the Area Redevelopment Act the responsibility for planning and furnishing retraining services to unemployed and underemployed persons is shared jointly by the Bureau of Indian Affairs with the Department of Commerce, the Department of Labor, and the Department of Health, Education, and Welfare. In carrying out these

responsibilities, employment skills have been reviewed in communities across the country and 16-week refresher and retraining courses have been submitted, approved, and put in operation. Several such courses were initiated during the year in predominantly Indian communities. These included a project to train 200 workers for operation of the new sawmill on the Navajo Reservation, another to train 40 farm machinery operators on the Fort Berthold Reservation in North Dakota, a third to train 25 farm machinery operators on the Colorado River Reservation in Arizona, and a fourth to train 16 apprentice carpenters for work on housing developments on and near the Pine Ridge Reservation in South Dakota.

Manpower Act May Help

Another possible resource for developing Indian occupational skills is the program shaping up in the Department of Labor under the Manpower Development Training Act. Although funds were not available for this program in fiscal 1962, the Bureau reached general agreement with the Department of Labor that Indians should be helped under its provisions as soon as possible.

Prospects are that some additional assistance will be available from this source in fiscal 1963.

Program Beneficiaries Increase

The number of persons who received service of one kind or another under the Employment Assistance Program increased by roughly 30 percent during the year rising to 12,005 as compared with 9,690 in 1961. The table below shows the number of units (i.e., unattached individuals or family groups) who received the various types of service during the year and the total number of individuals who were benefited.

	<i>Units</i>	<i>Persons</i>
Relocation for direct employment.....	1, 866	3, 494
Relocation for vocational training (institutional):		
Training units carried over from previous years.....	907	1, 898
New units entered training during fiscal year 1962.....	1, 445	3, 035
Total served during fiscal year 1962.....	2, 352	4, 933
On-the-job training services:		
Training units carried over from previous year.....	227	726
New units entered training during fiscal year 1962.....	838	2, 745
Total served during fiscal year 1962.....	1, 065	3, 471
Training of California Indians (Public Law 85-671).....	30	68
Training of Catawba Indians (Public Law 86-322).....	28	39
Total units served by program fiscal year 1962.....	5, 341	12, 005

Law and Order

As reported in previous years, legal jurisdictional problems continue to hinder or prevent the provision of adequate services for dependent or neglected Indian children on reservations in several States. Commitment of adult Indians, as well as children, to appropriate State institutions has also been hampered.

A New Mexico State court took the legal principle that a State has no jurisdiction over offenses by Indians within Indian reservations in the absence of congressional legislation providing such jurisdiction and applied this principle to the case of a non-Indian arrested within a reservation by State authorities and dismissed charges against him. The case is on appeal to the State supreme court. In the meantime, State law-enforcement authorities are continuing to enforce State laws against non-Indians within Indian reservations.

State authorities in Idaho, where the State had been assuming jurisdiction over offenses by Indians within the Coeur d'Alene and Nez Perce Reservations, questioned their jurisdiction to continue their activities on the basis of the U.S. Supreme Court's decision in *Seymour v. Schneckloth*, decided in January 1962. This decision held that the town of East Omak was within the Colville Reservation and was therefore "Indian country" as that term is defined by law for the purpose of limiting Federal jurisdiction. At the close of the fiscal year, State authorities had all but ceased their maintenance of law and order among Indians on these two reservations and it appeared that State legislation pursuant to the act of August 15, 1953 (Public Law 280, 83d Cong.), would be necessary to clarify the jurisdictional situation or it might become necessary to reestablish Indian courts on these reservations.

The North Dakota Legislative Research Committee conducted a study, with hearings among Indian people on the reservations and among other citizens, looking to the improvement of the status of Indian people in North Dakota. In the field of law and order, the committee indicated that it would recommend enactment of State legislation to assume civil jurisdiction with respect to reservations but, in view of the objections of the Indian people, would not recommend assumption of criminal jurisdiction.

In 1957 the State of Washington enacted, pursuant to Public Law 280, 83d Congress, a statute that permits the Governor, upon petition of a tribal council, to extend civil and criminal jurisdiction of the State to the Indian people on the reservation. Previously, 10 such reservations were subjected to State jurisdiction. During the fiscal year 1962 one tribe, which had to date declined to petition the Governor for State jurisdiction, did present such a petition requesting

the extension of State jurisdiction on a "piecemeal" basis. The request included some areas of civil jurisdiction and some areas of criminal jurisdiction. This action was taken shortly before the close of the fiscal year and, at the close of the year, the request had not been acted upon.

Welfare

In fiscal 1962 the need of Indian families for general assistance continued to increase due mainly to the continued decrease in employment opportunities. The increase in provision of social services to families and individuals, not receiving financial assistance, also continued as well as requests for social services to the tribal courts. Child welfare services to dependent, neglected, and handicapped children received major attention, and counseling services in planning constructive use of restricted individual funds were provided to Indians in need of assistance in managing their affairs.

General Assistance

The trend in a steadily increasing caseload and expenditure for general assistance was due largely to lack of employment opportunities for unskilled labor because of continued mechanization of agricultural operations. The average monthly caseload of persons was nearly 23 percent higher than in 1961 and expenditures for general assistance in 1962 was over 22 percent higher than in 1961. The greatest increases occurred in the Aberdeen, Billings, and Phoenix areas.

The number of needy Indians receiving general assistance followed the usual seasonal pattern from a low of 3,095 households of 8,864 persons in July to a high of 6,761 households of 23,302 persons in February. The average monthly payment was \$77.55 per household. The average monthly caseload was 4,830 households of 15,642 persons.

Social Services

Social services were provided to all families, individuals, and children in need of counseling or guidance when receiving general assistance. In addition, over 10,000 families and/or individuals, who did not receive general assistance, received counseling, guidance, and assistance in working through their individual problems.

Increasingly, the Indian people on the reservations are coming to the social workers to ask for their services and the requests from the tribal courts have overloaded the agency social workers' caseloads.

Child Welfare

Special emphasis has continued to be placed on providing social services to children in need of care, whether in their own homes, in specialized institutions for the physically handicapped or mentally ill, in foster homes or in adoptive placement. During the year 2,400 children were under care.

The Indian adoption project conducted under a contract with the Child Welfare League of America, whereby homeless children are referred by Bureau social workers on selected reservations for adoptive placement to qualified adoptive agencies selected by the Child Welfare League of America, progressed satisfactorily. During the past year, 28 Indian children, ranging in age from birth to 7 years, were placed in adoptive homes in 13 different States. This brings the total of children placed under this project to 63. Both public and private child welfare agencies participated in these placements. The increase in the number of children placed, in the number of agencies participating, and in the number of States involved gives evidence of greater and more widespread interest in the problems of Indian children.

Bureau of Land Management

Karl S. Landstrom, *Director*



A new frontier in public land management was defined by President John F. Kennedy in his two special messages to the Congress of the United States. In 1961 he said:

“Our country has been generous with us—we cannot now ignore her needs for future development.”

“The Federal Government owns nearly 770 million acres of public land—public domain lands amounting to some 477 million acres are a vital national reserve that should be devoted to productive use now and maintained for future generations.”

In 1962 President Kennedy stated:

“We must reaffirm our dedication to the sound practices of conservation which can be defined as the wise use of our natural environment; it is in the final analysis the highest form of national thrift—the prevention of waste and despoilment while preserving, improving, and renewing the quality and usefulness of all our resources. Our deep spiritual confidence that this nation will survive the perils of today—which may well be with us for decades to come—compels us to invest in our nation’s future, to consider and meet our obligations to our children and the numberless generations that will follow.”

Pointing directly at many of the needs, the President said:

“Adequate outdoor recreational facilities are among the basic requirements of a sound national conservation program . . . the water that courses through our rivers and streams holds the key to fill national development . . . more intensive management is now being applied to public domain lands but still more needs to be done . . . timber growth, particularly in soft woods, must be increased significantly if we are to meet the nation’s projected

future requirements for wood products. The growing of timber is a long term project requiring concerted public and private efforts and considerable advanced planning . . . during the last thirty years this nation has consumed more minerals than all the peoples of the world had previously used but present availability of raw materials must not blind us to tomorrow's requirements . . . in the work of conservation time should be made our friend not our adversary. Actions deferred are frequently opportunities lost, and in terms of financial outlay dollars invested today will yield great benefits in the years to come."

The steps taken by the Department of the Interior through the Bureau of Land Management during fiscal 1962 to meet the challenge laid down by the President are the subject of this report.

The responsibilities of the Bureau include the custodianship of the national land reserve (167 million acres of public lands mostly in the Western States), the public domain in Alaska (309 million acres), the reinvested Oregon & California Railroad grant lands (2.1 million acres), mineral leasing on the Outer Continental Shelf, and other functions related to natural resources.

Public Land Anniversaries

This year marked the sesquicentennial of Federal administration of public lands, which began in 1812 with the founding of the General Land Office, now the Bureau of Land Management.

In a special proclamation, President John F. Kennedy designated this year for official commemoration of significant anniversaries in the history of the public domain. Three of these to be marked were the Homestead Act of 1862, the Land-Grant College Act of 1862, and the Transcontinental Railroad Land-Grant Act of 1862. Special ceremonies were held in all of the Western States.

The history of the Bureau is the history of the development of the Nation. As the landlord of the public domain, the General Land Office assisted in the development of the country through the transfer of millions of acres to private citizens, colleges, railroads, States, and others. From this same public domain were carved most of the national parks, national forests, and Indian reservations.

This phase of our Nation's history has passed, and the emphasis has changed from disposal to management. The Bureau, performing the Nation's largest land managing job, has been prominent in conservation and land development.

Legislation

Under the authority of the public land laws, more than 1.1 billion acres of the original public domain have been transferred to private

and other non-Federal ownership. Today the Bureau of Land Management is responsible for the conservation, management, and development of some 467 million acres of the Nation's public lands.

During 1962 the Department was active in studying the public land laws of the United States and formulating recommendations for their amendment and modernization. Special attention was given to drafting new legislation which would authorize land dispositions in a manner required to meet the needs of an increasingly industrialized and urbanized society.

One of the most important proposals asked by the Department was the so-called omnibus bill, which would authorize the classification, segregation, lease, and sale of public land for urban, business, and occupancy sites. Such a bill would repeal a number of obsolete or inadequate laws.

Another piece of legislation asked by the Department consisted of amendments to the homestead and desert land laws. It would provide for higher standards for the classification and development of



The moratorium on public land applications, in effect during 1961, greatly aided the Bureau in its land classification work by providing time to deal with a large backlog of applications. Here two BLM specialists review the suitability of an area for recreational development.



Cows and calves graze contentedly on the Federal range, while a study of grazing fee rates is being conducted to insure their future welfare.

agricultural lands, and would require payment for the lands under terms more in keeping with the value of the resources.

Other legislation would amend Section 8 of the Taylor Grazing Act by broadening the exchange provisions of the act. Such authority would permit consolidation and better management of the national land reserve.

Another proposal sent to the Congress called for a revision of the right-of-way laws which would pull together and update a hodgepodge

of outdated provisions. It would facilitate the granting of easements for needed private and public purposes.

Under existing law, lands valuable for locatable minerals may be disposed of only under the U.S. mining laws. Another proposal by the Department calls for authority for the Secretary to dispose of mineral lands under the nonmineral laws when he finds that they are more valuable for their surface uses and resources than for their mineral deposits.

A proposal studied by the Bureau of Land Management would provide for the recordation of mining claims on the public lands and for a system of exploration mining claims to cover the period prior to discovery of valuable minerals.

Important legislation passed this year by the Congress included an act to repeal obsolete laws relating to military bounties. It provides that the Secretary of the Interior may purchase outstanding valid military bounty land warrants for \$1.25 per acre.

Another act passed by Congress authorized the Secretary to sell certain lands in Idaho which were omitted in the original survey of the lands.

Lands and Recreation

The public land laws provide the means by which the American public may obtain patent to the public lands. But by 1961 the number of applications for public lands had reached staggering proportions. To permit the Bureau to eliminate this overwhelming backlog of applications, to review the land management situation, and to develop land management objectives, Secretary Stewart L. Udall ordered an 18-month moratorium in February 1961 on most kinds of applications for public lands under the nonmineral public land laws.

The privilege of filing applications had in recent years been used by some unethical land locators and promoters in an attempt to bilk the public out of millions of dollars. At the same time, the flood of promoter-inspired applications hampered honest citizens in their desires to acquire public lands.

By June 30, 1962, 2 months before the moratorium was scheduled to expire, excellent progress had been made in reducing the backlog of more than 41,000 applications. About 18,000 cases were left, a reduction of 57 percent. Outside of Alaska, where the moratorium had only minor application because of the settlement laws, progress was even more encouraging with a two-thirds reduction. The moratorium was lifted ahead of schedule in eight of the States affected by it.



Loon Lake in western Oregon is an example of the outstanding recreational developments being constructed in the revested Oregon & California Railroad lands—where special funds are available for BLM developments of recreation potentials. This popular site furnishes boat launching, swimming, picnicking, and overnight camping.

Sales of land and other dispositions were not stopped by the moratorium. Over 4,000 small tracts were offered for sale at public auction in southern California. Several other offices conducted regularly scheduled public auctions of public lands. The moratorium

allowed the Bureau to take more timely actions on pending cases to meet the requirements for land of local communities and individuals.

Studying the National Land Reserve

In direct response to the President's call for an "inventory and evaluation of the Nation's public-domain holding" the Bureau put into operation a master unit study system for the national land reserve. The system recognizes that these residual public-domain lands are attaining greater importance yearly, both as a reservoir of underdeveloped land for intensive public and private use and as an area needed for balanced resource use by the public in general.

The system also recognizes that land demands and uses are changing. Employees of the Bureau of Land Management working with the old agricultural land laws are aware that they are not operating in the manner popularly assumed. To determine what the facts really are, a two-phase effectiveness study was started. Enough of the facts are in to lead to some conclusions.



BLM's current work to clear up about 18,000 cases of unauthorized use of public lands has resulted in restoring much land to authorized development, such as this small tract site in Alaska.

The first part of the study covered the land applications under the Homestead Act, the Desert Land Act, and the Pittman Act for the 10-year period 1950-59 in 11 Western States.

Approximately 25,000 applications for public lands were filed under the 3 acts during the period of the study. The results of the initial applications are as follows:

Type	Percent allowed	Percent denied
Homestead applications.....	14	86
Desert land applications.....	17	83
Pittman Act applications.....	11	89

Chances for securing an entry—having an application approved—varied from State to State. Of the homestead entries allowed, 57 percent were in Nevada and Utah. Of the desert land entries, 64 percent of those allowed were in Idaho and Nevada. The Pittman Act applies only to Nevada.

Of those entries allowed, only about 50 percent of the homestead and desert land entries went to patent. Under the Pittman Act, only about 1 out of 100 were patented.

New Programs

A new type of public land management program has been introduced under Secretary Udall—the establishment of 11 national cooperative land and wildlife management areas in California. These areas are managed by the Bureau of Land Management for the development, conservation, use, and maintenance of outdoor recreation facilities as well as wildlife and other natural resources. Advice and cooperation will be provided by the Department's Fish and Wildlife Service and by the California State Game and Fish Department.

The public lands involved have been withdrawn from application or entry under the nonmineral public land laws. The land will continue to be open for mining and mineral leasing, livestock grazing, public outdoor recreation, and other uses administered by the Bureau of Land Management.

In another development, Secretary of Agriculture Orville L. Freeman and Secretary Stewart L. Udall initiated land jurisdiction studies involving the two Departments. The purpose is to improve the administrative boundaries of lands administered by the Forest Service and the Bureau of Land Management. Often the two Departments have jurisdiction over adjacent stretches of land, and some jurisdictional trades may prove desirable. The timetable

established by the Secretaries sets January 1, 1963, as the target date for the first land adjustment proposals to be formalized.

Recreation on Public Lands

A major gap in the national land program was identified by Secretary Udall when he announced on September 11, 1961, that: "The provision of open spaces for outdoor recreation is one of the most important objectives of the national land reserve. Plans are to give recreation the same degree of attention as is given the more traditional management programs for such resources as range, forage, commercial timberland and leasable and hardrock minerals."

The report of the Outdoor Recreation Resources Review Commission also called attention to the long-standing neglect of this important national resource.

To translate this new emphasis on outdoor recreation on the national land reserve into constructive action, a continuing inventory and



This Arizona park was developed under the Recreation and Public Purposes Act. A pricing schedule instituted in 1961 enables States to buy recreation lands for \$2.50 an acre. Such minimal land costs permit States to develop areas more rapidly.



Management of recreational lands is getting increased attention under BLM's new programs. The visitor protection program provides wayside shelters and eliminates visitor hazards from recreation areas.

evaluation of the existing and potential outdoor recreation resources of these lands has been started.

Preliminary inventory information indicates that outdoor recreation is already an important activity—existing or potential—on over 50 million acres of Bureau of Land Management lands, not including Alaska. Over 4,000 sites involving 4½ million acres have been identified as suitable for intensive recreational use and the installation of facilities.

In the current inventory, first consideration is given to areas that have good potential as national parks, monuments, or recreation areas.

Another priority concerns areas that may be suitable for administration by States, counties, or municipalities. Many such areas near established population centers or along public highways and other special areas are being identified for lease or sale to local governments under the Recreation and Public Purposes Act. These are areas that have potential for heavy use and are the most convenient for operation by local government. A special pricing schedule of \$2.50 an acre was instituted this year which brings lands for recreation into the financial reach of many communities.

The Bureau of Land Management has constructed 22 camping and picnic sites on O&C lands in western Oregon. These include facilities. Need for recreation facilities exists on more than 2,500 identified sites on the national land reserve. They are located in multiple use resource management areas where the Bureau of Land Management is in an excellent position to coordinate recreational uses with other uses.

Forest Resources

To provide for the future needs of our growing Nation, the Bureau of Land Management is constantly alert to changing conditions which affect the management of forest resources. The Bureau is planning for increased use of public lands entrusted to its care. In forest management an important goal is the growing of more wood fiber from fewer acres.

By applying the latest techniques in forest management practices, the Bureau is striving to meet this challenging situation of intensive multiple use of the Nation's forest lands.

Uniform Practices

Following President Kennedy's request in 1961, the Secretaries of Agriculture and the Interior began a cooperative study of timber sale and management practices on Federal forest lands with the objective of approaching uniformity in these practices.

Differences in timber sale practices and forest inventory procedures are being studied and evaluated. A group was designated to study the inventory and allowable cut procedures of both agencies.

On August 28, 1937, the O&C Sustained Yield Act was signed into law. This marked the beginning of a sound forest policy for administering a unique area of public forest lands in western Oregon. Since then, the U.S. Treasury has gained more than \$30 million over and above all costs of acquiring, holding, and managing these 2.1 million acres of some of the finest timber in the Nation.

During fiscal year 1962, the public-domain lands in western Oregon were combined with the Oregon & California Railroad grant lands (O&C) and the Coos Bay Wagon Road lands (CBWR) to calculate a new annual allowable cut of 977 million board feet—an increase of 26 million feet over the previous allowable cut. This combination, plus more refined inventory procedures, was followed within a month by another allowable cut of 1.127 billion board feet—an increase of 176 million board feet. The volume of timber sold from these lands during the past year totaled 834,339,400 board feet valued at



BLM employees scale sugar pine trees to harvest cones resulting from controlled hand pollination. Such methods produce strains which can resist the pine blister rust, a deadly forest enemy.

\$20,409,831.12. Also contributing substantially to the economy of western Oregon was 83,363,100 board feet of salvage and thinnings not chargeable against the allowable cut.

The Bureau of Land Management administers about 4 million acres of other commercial forest lands in Western States in addition to 29 million acres classified as woodland from which a variety of

wood products are sold. Timber sales from public-domain lands contributed almost 139 million board feet of timber valued at nearly \$2 million.

Forestry Inventory

A full and complete inventory of forest lands is necessary for sustained-yield management. Permanent sample plots are being established so that periodic reinventory can be taken. This provides for accurate, up-to-date information, vital to management plans and allowable cut computations on the changing conditions of the forest unit.

Reforestation

To establish stable economic conditions of an area primarily dependent upon timber for its present and future livelihood, cutover lands must be promptly restored to a productive state. Loss of jobs and taxes results from reduced resource production. Recently cutover lands are subject to erosion and the invasion of undesirable brush species which hamper the growth of commercial species.

Reforestation accomplishments for the Bureau for 1962 include 28,043 acres by planting and 16,424 acres by direct seeding. Total area reforested up to July 1, 1962, on Bureau-administered lands amounts to 172,572 acres. By 1965, complete reforestation of backlog acres on the O&C is planned. Completion on public domain is scheduled for 1970. Thereafter, reforestation will be on a maintenance basis for denuded burns and recent cutover areas not adequately reforested by natural means.

Bureau foresters, aware of the problems in obtaining adequate regeneration of some areas, are continually experimenting with new methods of planting and seeding. One recent experiment involved the use of a heavy paper mulch around planted seedlings. Results showed that the paper reduced competition from grass and brush adjacent to the seedling, resulting in a significantly higher percentage of seedling survival. The method has been widely used in areas where moisture and vegetative competition are critical factors.

In an effort to aid reforestation, site improvement treatments were given to 7,054 acres of forest lands. Snags felled on 3,145 acres accounted for the largest acreage treated. Other site improvement practices included scarification of the forest floor, herbicide treatment—the application of chemicals to eliminate weed species—and mulching.

Forest Thinning

The prime objective of a thinning program is to produce selected crop trees and remove salvage, competitive, or undesirable trees. To this beneficial result is added additional income from the forest property by obtaining volume otherwise lost to natural causes. During fiscal year 1962, 8,376,000 board feet of commercial thinnings were removed from approximately 1,226 acres in Oregon alone. This represents bids totaling \$127,532. Precommercial thinnings in stands having no merchantable volume or value under existing utilization standards were completed on 420 acres.

In the past, management plans have been geared to the harvest of old-growth timber. In a short time, the nation will be dependent upon young growth to supply its needs. A study is being initiated in the Tillamook area of Oregon to analyze all aspects and effects of intensively managed young-growth stands.

Access Roads

A dynamic forest management program cannot be carried out without a good access road system. In order to place mature timber on the market and to salvage dead and dying timber due to overmaturity and wind throw, and to protect these forests from insects, disease, and fire, the Bureau of Land Management has constructed many miles of high-standard logging roads.

Access roads serve other important uses. As the trend continues toward increasing acreage of second-growth timber to be managed, thinning programs are more important. Roadbuilding, added to the cost of the actual thinning of small material, may make the operation a financial impossibility, especially for small operators. Thus, full utilization of forest property may not be realized.

Access roads serve many types of recreational use including fishing, hunting, and picnicking, and provide a means of making many acres of public lands accessible to the public.

Range Resources

The Bureau of Land Management is responsible for the administration, conservation, protection, and development of the range resources of public lands.

Basic to the management of the Nation's grazing lands is an inventory of the forage resources. The Bureau has intensified its

efforts to complete such an inventory. Initial grazing capacities have been established by means of forage inventories on about 70 percent of the 158 million acres of public rangelands included within grazing districts. These inventories provide the basis for stocking and management of the range to ultimately realize maximum sustained livestock and game production. Reappraisals will be necessary from time to time in the future to enable the matching of grazing use with the changes in range condition and forage production.



These bighorn elk shared the Federal range with about 1.4 million other big-game animals in the past fiscal year.

Modification of range survey procedures have been made in some districts to further refine results. More accurate qualification of survey data has been possible as actual use data, utilization studies for different forage plants, and the influence of annual weather variations have become available.

Public Land Range Appraisal

In accordance with a request contained in the Senate Report No. 294 which accompanied the 1962 Department of the Interior appropriation bill, a trial program for an appraisal of public range-

lands was conducted jointly with the Forest Service, U.S. Department of Agriculture. This study embraced three sample areas in Oregon, Montana, and Colorado. Data were assembled on range condition and trend, present and potential grazing capacity, needed improvements, and related items.

A report, together with a prospectus for the public land range appraisal, was submitted to the Congress. The prospectus contained estimates of cost and time needed to complete an overall range appraisal by alternative procedures.

The report shows results such as the following in the three areas:

Colorado (San Luis Valley): Vegetation conditions were largely fair or poor. The pattern held true through all major vegetation types with the exception of the meadows.

Soil stability conditions were fair on about one-half the area. Most of the remaining acreage was good or poor—in about equal proportions. Soil stability was good on one-half or more of the meadow, conifer, and broadleaf type acreage. However, nearly all of the grassland and half shrub types displayed fair or poor soil stability. Excellent vegetation and soil stability conditions were found only in large cattle allotments. Summer ranges showed a greater proportion in poor or very poor condition than spring-fall or winter ranges. Very poor conditions were confined entirely to summer allotments.

Ranges in poor or very poor vegetation condition and others in a downward trend made up 40 percent of the total acreage.

Existing range improvements represent an investment averaging \$1.15 per acre of Federal lands suitable for domestic livestock grazing. Needed improvements will cost an average of \$2.45 per acre.

In the past, stock trails, access roads, and fences received the most emphasis. Range seeding, plant control, and water runoff measures are now considered to need more emphasis.

The average current capacity was 64 animal unit months per section of suitable range. Average potential-capacity was estimated at 71 animal unit months per section.

Montana (Beaverhead and Madison Counties): Vegetation and soil stability conditions were rated good or fair on 90 percent or more of the range sampled. Meadow and conifer types had higher proportions in good condition than did other major types. Grasslands and meadows were the only types having an excellent vegetation rating, but all major types had a small proportion displaying excellent soil stability conditions.

The large allotments and summer ranges had a higher proportion in the poorer condition classes than did the small allotments and spring-fall ranges.

Ranges in poor or very poor vegetation condition and other ranges with a downward trend made up 34 percent of the total acreage.

Existing improvements represent an investment averaging \$2.50 per acre of suitable rangeland. Needed improvements will cost an average of \$5.65 per acre.

In the past, most of the improvement dollars were spent on fencing and sagebrush control. These practices will continue to receive the most emphasis, but large investments are also needed for stock water development, construction of roads and trails, and for allotment boundary marking.

Fences received most of the past investment dollars on cattle allotments, while most of the funds expended on sheep allotments were for sagebrush control. In the future, plant control as well as fencing will be emphasized.

The average current capacity was estimated at 194 animal unit months per section of suitable range. Upon attaining potential capacity an average of 278 animal unit months per section will be available for grazing.

Oregon (Lakeview area): Most of the vegetation was in the less desirable condition classes. Soil stability conditions were somewhat better, a large proportion being in fair or good categories.

Poor or very poor vegetation conditions predominated in all major types with the exception of the conifer. This type, although having a large proportion in poor condition, also had a sizable proportion in fair and good condition and a small amount in the excellent class.

The conifer type, with one-half of its acreage displaying good or excellent soil stability, was in the best condition in that respect. However, all of the major types in the Oregon area showed a preponderance of fair or better soil stability.

Ranges in poor or very poor vegetation condition and others with a downward trend made up 70 percent of the total acreage.

Existing improvements represent an investment averaging 35 cents per acre of suitable rangeland. Needed improvements will average 65 cents per acre. The report states, however, that these estimates appear unrealistically low.

In the past, fencing received the most emphasis. Fencing will continue, but other improvement needs including seeding, plant control, stock water development, and roads and trails will receive increasing emphasis.

The average current capacity was 44 animal unit months per section. Upon reaching potential capacity, an average of 60 animal unit months per section will be available for grazing.

Range Condition and Trend

Range condition studies have been vigorously pursued in order to attain cumulative yearly information which makes possible the refinement of data gathered by the forage resource inventory.

The cumulative summary for the calendar years 1955 through 1961 shows the following classification of range conditions for the usable rangeland area: Excellent, 1.6 percent; good, 15 percent; fair, 53.1 percent; poor, 25.8 percent; and bad, 4.5 percent. The trend of range condition for the same area at this time is reported to be 20 percent improving and 17 percent declining. The remaining 63 percent is either static or was given no rating.

The changes from reports of preceding years are small, but they represent some evidence of improvement over the declining trend that has prevailed for many years. Most States report some ranges as still declining, but there are some States that have definite areas of improvement.

Rehabilitation of ranges through better management, by greater use of range seedings, and by construction of improvement facilities is credited with part of this improvement. Damage from fire during the year was much less than normal.

A few States reported subnormal precipitation, but in most areas the past winter and spring have been the best in many years. As the fiscal year drew to a close, it appeared that the long drought of recent years has been broken.

Study of Ranch Economics

A study of ranch economics by the Economic Research Service of the Department of Agriculture and three State agricultural experiment stations under cooperative agreements with the Bureau of Land Management and the Forest Service was conducted during the year. Basic economic data were collected from 700 western ranchers. Budgets on costs and returns were completed for 80 typical ranches representing several sizes and 27 ranch types using public ranges. This is the first extensive research project to study livestock ranches throughout the West uniformly and simultaneously.

The study will yield factual information on how modern range livestock ranches are operated, what their long term costs and income situations are, how significant grazing fees are as part of ranch operating costs, how increased grazing fees will affect ranch incomes, and how adjustments in grazing privileges affect stability of ranch operations.



A rangeland plow removes sagebrush to allow grass to take its place. Under careful management, about 20 percent of overused rangeland is now improving in quality.

Grazing Fees

Consideration has been given during the reporting period to the basis and situation concerning grazing fees charged for the use of public lands administered through the Bureau of Land Management. Various economic and appraisal data have been obtained and carefully analyzed. The effect of fees upon the costs and returns of ranches has been investigated.

The National Advisory Board Council and the State and district advisory boards were asked to complete a study of grazing fees and make their recommendations concerning proper and equitable charges for grazing use of the Federal range. The board members considered various kinds of economic and value data including a preliminary report of the economic ranch study by the Economic Research Service.

Research

The challenge of public land management could not possibly be met without better basic data obtainable only through research.

The Bureau has increased its cooperation with Department of Agriculture research agencies and the land-grant colleges and experiment stations.

Grazing trials on cheatgrass ranges and depleted watersheds are being conducted by the Forest Service in cooperation with the Bureau of Land Management. Vegetation conversion studies, including the replacement of Medusahead wildrye, halogeton, and other noxious weeds; revegetation of cheatgrass, salt desert, and other low rainfall ranges; and the control of several low-value brush species are being conducted in cooperation with the Agricultural Research Service and several State agricultural experiment stations. The Department's Geological Survey also participates in these projects. Economic studies are made by the Economic Research Service and the State experiment stations under cooperative arrangements.

Utilization Surveys

Studies of current utilization of forage species are conducted on certain areas of the range which involve a particular management problem. Some of these include livestock and game use concentration areas, allotments scheduled for intensive improvement, and range survey areas for which proper use data is needed.

These surveys provide guides for livestock use adjustments and the establishment of hunting regulations in cooperation with State and Federal game managing agencies. Care is taken to consider the normality of current forage production in connection with utilization surveys.

Range Adjudication

Current plans provide for the completion of range adjudication by July 1, 1967. Early completion of this activity is of utmost importance since it provides the base from which an intensive range management program can proceed. Range adjudication includes the determination of the extent of individual base property qualifications for use of the range and the equitable apportionment of the available forage production among the applicants within the proper grazing capacity and season of use of the range.

Wildlife

The rapidly accelerating need for outdoor recreation makes it desirable and necessary that the public lands make the greatest contribution possible in providing wildlife enjoyment opportunities in balance with other needs and uses of the resource.

Maximum sustained yields of wildlife can be obtained only through proper management of wildlife habitat. To assist in obtaining this ultimate objective, wildlife biologists or game management specialists were added to the Bureau staff in most of the Western States. During the year the total number of big-game animals that used the Federal range (exclusive of Alaska) increased from an estimated 1,382,323 to 1,409,347.

Resource Development and Conservation

The Bureau realized that to meet the challenge of the 1960's the watershed planning effort would have to be greatly accelerated. Steps were taken to put the planning on a sound basis and to give it its required priority.

The inventory of presently serviceable projects which was underway at the beginning of the year was speeded up by an all-out effort. All projects which were no longer needed, which were beyond repair or for other reasons were deemed unnecessary, have been abandoned. Required maintenance work on other projects has been noted and integrated into current work plans. Conservation surveys have been carried out either in conjunction with range forage inventories or in addition to these studies to determine the total needs of each watershed.

A statement of the Bureau's development and conservation needs was compiled and issued. A schedule was worked out whereby the soil and moisture conservation program would be expanded over a 5-year period to reach a level at which the job can be accomplished within a reasonable time.

During this period of accelerated planning, several new approaches to the problem were analyzed. The one which seemed most suitable was a "project area" approach, similar to that used for water use and control projects. Under this concept field offices would delineate an area for complete conservation treatment. This may be a community watershed, a group of community watersheds, or an entire district. If the plan is approved, appropriations would be requested for the construction phases of the project program. Four such areas were delineated and have been approved for initiation in fiscal year 1963. The four projects are in the Vale district of eastern Oregon, Owyhee district in Idaho, the Winnemucca district in Nevada, and on the Rio Puerco watershed in New Mexico.

Nineteen hundred and sixty-two was the second year in which supplemental appropriations were obtained for the rehabilitation of burned out lands. The Bureau received \$1,250,000 for the reforestation of forest lands and the seeding of rangelands damaged by fire.

Weed Control

The Bureau recognizes that the large majority of weed problems are solved through the soil and moisture conservation program and improved management. Nevertheless, action is taken to control weeds which are posing a particular problem in a local area, either because they are poisonous to livestock or serve as reservoirs for reinfestations of agricultural lands or for other reasons. Primary emphasis in the control, research, and study programs are concerned with halogeton, Medusahead rye, and alternate host plants of the beet leafhopper.

Halogeton, a plant poisonous to livestock, has been at the top of the list for weed control since 1952. No method of complete eradication is known. Objectives now are aimed at controlling the density of the plants and furnishing sufficient usable forage so that livestock will not eat a large enough quantity of halogeton to cause death.

The infestation of Medusahead rye, an aggressive invader, has more recently reached such proportions that it must be controlled. Cooperative research projects are being pushed for methods to control this weedy species through range seeding and management, as well as by chemical methods.

The beet leafhopper, carrier of curly top virus, has caused millions of dollars worth of damage to seed-bean growers in southern Idaho. Alternate host plants used by this insect are Russian thistle, mustard, and other annual weeds growing on nearby rangelands. The thistle, mustard, and other weeds are not particularly difficult to control, but in southern Idaho they grow in conjunction with dense stands of cheatgrass. The cheatgrass makes the establishment of perennial grass species a difficult undertaking. Research on control of cheatgrass and the establishment of perennial grasses in such cover is being carried on. Land treatment practices are going forward in those areas which are predominantly covered by big sagebrush where success is fairly well assured.

Other weeds of local importance include snakeweed, larkspur, white-top Russian knapweed, wyethia, leafy spurge, and camelthorn. In addition, the States bordering Mexico are apprehensive about a new poisonous weed which is threatening to invade from that country called Alfrombia.

Mineral Resources

The Bureau administers the disposition of the mineral interests of the United States, including those on forest lands, acquired lands, military reservations, parks, monuments, etc., and the Outer Continental Shelf, in addition to public lands otherwise administered. These

mineral interests afford a sizable part of the country's mineral output and contain many reserves needed to sustain the activities of the minerals industry.

In line with the President's natural resources messages, the Bureau of Land Management instituted a program designed to create a balanced use of the country's lands and natural resources, responsive to the needs of the public and consistent with acceptable conservation practices.

Under this program, the Bureau will make a comprehensive analysis of the mineral resources, both existing and potential, found on the public lands. The data will be given consideration in all decisions relating to the management of the national land reserve.

In order to obtain the information on which to base its decision, the Bureau has undertaken a project to compile information on the mineral resources of the lands it administers. The initial inventory is scheduled for completion by the end of the 1963 fiscal year. Once this data is cataloged and compiled, it will be analyzed in detail and integrated with the results of a minerals economic study that is to be conducted concurrently and the results will be embodied in the Bureau's overall resource management program. All data and analyses will be updated and reevaluated in light of any significant mineral discoveries and advances in mineral technology.

One of the objectives of the project is to prevent the inclusion of valuable mineral lands in developments not compatible with mineral exploration and exploitation.

In an effort to keep pace with the social and economic growth of the country, the Bureau has encouraged study of ways to modernize the general mining laws of 1872. A draft of proposed revisions was distributed within the minerals industry and to interested organizations for review and comment. A number of recommendations and suggestions were received and are being considered.

Alaska

Oil and gas production increased sharply in Alaska during the year, notably on the Kenai Peninsula. In view of the extremely high cost of mineral exploration in Alaska and the operational difficulties in relatively undeveloped areas, the development of these new oil and gas fields must be looked upon as a major accomplishment in the development of the Alaskan mineral resources. The discovery and production of large quantities of oil and gas should accelerate the economic growth of the State and provide additional stimulus to future mineral exploration.

Outer Continental Shelf

Interest in mineral leasing on the Outer Continental Shelf continued throughout the year and bonus bids received for the 1.913 million acres leased during the period totaled approximately \$446 million. In addition to the offshore oil and gas activity, considerable interest was shown in other minerals. Leases were issued for salt and sulfur in the Gulf of Mexico and for phosphorite on the submerged lands off the coast of California.

Preliminary investigations indicate that, once techniques are developed for the economic exploitation of these underwater mineral deposits, they will add considerably to the Nation's usable mineral reserves. It is expected that one day, a substantial amount of the Department's work will be involved in offshore mineral leasing activities.

Statistics

Preliminary figures representative of the scope of mineral activities during the 1962 fiscal year follow:

Oil and gas filings and lease applications*-----	222, 800
Other lease applications (sodium, potassium, etc.)-----	556
Mineral patent applications received-----	167
Mineral classification and investigation cases processed-----	15, 200
Mining claims involved in mineral contests-----	466
Acres involved in Public Law 167 determinations (combined Forest Service and Bureau of Land Management)-----	28, 143, 835

*Includes simultaneous filings.

Protection of Resources

It is essential that the lands and resources under BLM jurisdiction be protected against the destructive forces of nature and the carelessness and willfulness of man. The protection of these resources covers many fields—prevention and suppression of wildlife, control of unauthorized use, control of insects and diseases destroying forests, and protection of visitors on the national land reserve.

Fire Control

Fire has become one of the principal enemies of forests, rangelands, and watersheds. During calendar year 1961, the number of fires and area burned was less than the 5-year average. The total of 1,097 fires burned 147,259 acres, compared with the 5-year average of 1,430 fires which burn 1,433,291 acres annually. The fire control objective was to train, organize, and develop a force to hold losses to a minimum.



Forest fires destroy many valuable acres of public lands. This year, the number of fires and acreage burned was less than the 5-year average. The number of fires was 333 below the average.

Fire Conditions

Generally favorable fire weather resulted in depressed burning conditions in Alaska with fire occurrence much below previous years. In other States, fire conditions were quite varied. Most States experienced dry spring weather following reduced winter precipitation which resulted in early curing and drying of herbaceous plants and early conditioning of heavier fuels in higher elevations for rapid burning. Summer rains in some States relieved the drought conditions and reduced the fire hazards. Fire fuels were reduced by spring drought conditions which was reflected in fewer fires and less rapid spread of those which occurred. The combination of these elements, coupled with aggressive attacks, aided in holding resource losses to a minimum.

Lightning Fires

Lightning caused 62 percent of the fires suppressed by the Bureau of Land Management in 1962, compared to 49 percent during the calendar year 1960. Oregon experienced the greatest increase of lightning fires, amounting to nearly 50 percent.

Availability and Effectiveness of Firefighters

Organized Bureau suppression teams were used very effectively in several States. These crews, well trained and mobile, though few in number, were effective in reaching and suppressing fires while they were small. The Bureau, in cooperation with other fire protection agencies, participated in the organization and training of Indian and Mexican crews in New Mexico, Arizona, Nevada, Idaho, and Montana. In Alaska, the Bureau organized and trained Eskimo and Indian crews, as well as 20 smokejumpers. The specially trained and organized crews have been a great asset to the protection of lands and resources, supplementing the Bureau's regular personnel, particularly on project fires. The distribution of these highly trained and organized crews in strategic locations supplies a source of manpower so urgently necessary to combat large fires.

Adequacy of Protection

It is recognized that there are insufficient ground detection facilities on lands protected by the Bureau of Land Management's own staff. This continues to be an obstacle in obtaining prompt action on all fires. In spite of an intensive aerial surveillance, fires originate and spread over large acreages before they are detected and reported. The lack of an adequate network of truck trails and roads into large blocks of public lands delays prompt suppression of reported fires. Several years may elapse before the deficiencies existing will be overcome and the complement of lookouts, roads, and other operating facilities will reach a satisfactory operating standard.

Contract Fire Protection

Lands administered by the Bureau which are protected from fire by other protection agencies in Idaho, New Mexico, Oregon, Washington, and Minnesota experienced a season with above-normal climatic conditions. Lightning caused about 75 percent of the total number of reported fires on lands protected by contract.

Air Operations

Use of aircraft during calendar year 1961 increased nearly 100 percent over the 1959 season, and 29 percent over the 1960 fire season. More than 124,000 gallons of fire retardants were dropped on fires suppressed by the Bureau, with 82 percent effectiveness of all aerial drops. The slurry used consisted of bentonite and sodium-calcium borate as the retardant. Bentonite has been used predominately on light fuels and borate on heavier and deeper fuel types.

Each has been very effective when applied with wise consideration of the situation.

Control of Unauthorized Use

The primary responsibility is the elimination of unauthorized uses through public education and the development and maintenance of a positive system of control, supported by a vigorous investigation and enforcement program. Unauthorized use has become a chronic problem on the national land reserve, and a deterrent to sound and effective management.

There is an estimated backlog of various types of unauthorized use of 17,653 known or suspected cases, with a resource value of over \$16 million. These cases range from the unintentional to the criminal and are widespread in all the public land States. During 1962 a substantial inroad was made in the reduction of timber trespass.

Disease Control

A serious tree disease affecting timber administered by the Bureau of Land Management is white pine blister rust, a disease common to all five-needle pines. Eradication of the alternate host plant is the principal measure so far used for control. The alternate hosts for white pine blister rust are several species of a kind of wild berry called *Ribes*. *Ribes* eradication was conducted on forest lands in Oregon where sugar pine stands make up the major species of commercial timber. During the 1961 field season, 184,000 *Ribes* plants were treated and destroyed on approximately 1,500 acres.

Disease Suppression

There are two additional possibilities for control of blister rust which appear promising. One is the treatment of infected trees with a type of antibiotic. During the 1961 field season, 6,875 trees were treated on an area covering 181 acres. Studies and experimentation with the antibiotic for treatment of infected trees have not concluded that full-scale use should be made. However, apparent results point out its potential effectiveness.

Tree breeding also offers a great potential as a successful control measure. Cones from rust-resistant trees have been control-pollinated to produce a seed source. Cones from these trees should produce several pounds of seed to increase planting stock and continue the tree breeding program. Eventually either one or the other, or perhaps a combination of the two ventures, will replace present control methods of grubbing or chemically treating *Ribes* plants.

Insect Control

Insect infestations are difficult to detect and may cause considerable damage before reported. They may reach epidemic proportions before adequate control measures are effective. While they are less spectacular, annual damage by insects exceeds that caused by fire. Damage by fire promotes breeding of many species of insects—a vicious circle.

Infestations of bark beetles are reported in Montana, Colorado, California, and Wyoming. The most serious of these infestations was that of the Black Hills beetle in Wyoming. Control projects encompassed more than 76,000 acres—over 7,000 trees were hand treated. Adequate control of the infested areas is expected to extend over 3 years.

Visitor Protection

The accelerated impetus being given to recreation programs and the increased public use of the national land reserve have made it necessary that a visitor protection program be inaugurated.

The long-range objective is to identify, isolate, and correct hazards that threaten the general welfare and safety of public land recreationists; to provide for guidance to areas of natural interest, and for wayside shelters; to provide sanitation facilities and warnings regarding the existence of natural hazards; and to develop organizational expertise in the conduct of search-and-rescue operations.

During the second half of 1962, the visitor protection program was initiated and steps were taken in the training of personnel. Plans were laid for a progressive and unified program in cooperation with public safety officers, public peace officers, rescue forces, and recreation agencies.

Engineering

Before lands can be efficiently managed, physically identified, or before the title can be transferred, the lands must be provided with a legal description and acreage, and marked on the ground so that their boundaries are fixed by monumentation. The public land surveys provide these necessary “first steps” as the basis for subsequent management and administrative activities, not only for this Bureau but for all lands originally in the public domain. These surveys, together with the plats of survey which are their graphic representations, constitute the foundation land record which is the “starting point” for all subsequent transactions. No title action or transfer of lands surveyed under



A BLM engineer checks an original survey marker moved by the sea in Auk Bay, Alaska. Although only 1 percent of Alaska's 360 million acres has been surveyed, photogrammetry and other modern methods make it possible to survey large areas quickly.

the public land survey system, public or private, can be made without reference to these land records.

Furthermore, it is absolutely essential that on-the-ground inventory and management resource personnel—in addition to all users of the public land—be able to locate themselves in relation to property lines. This is the practical “down to earth” contribution of the system of public land surveys.

Surveys in the Public Land States

Although there remain some 112 million acres of unsurveyed public land in the public land States (not counting Alaska), much of this area is in permanent withdrawals or reservations where there is little immediate demand for original surveys. However, in recent years there has been a concerted effort to survey the remaining common school sections in the unsurveyed public lands outside the national forests, parks, and wildlife refuges. Such surveys are necessary before title to the school lands can pass to the States. Since the States have

the option of selecting "lieu" lands for unsurveyed school lands falling within permanent reserves, surveys of these areas for the sole purpose of identifying school lands are seldom necessary. This project is now substantially complete. While there will continue to be a demand for some original surveys, particularly in such States as Arizona, Nevada, and California, the cadastral survey emphasis in recent years has been, and will continue to be, on resurveys. Original surveys of some 425,000 acres were accepted during the fiscal year and over 3 million acres were surveyed in the field.

Resurveys

Resurveys are needed for the principal reason that much of the evidence of the original surveys which were made 50 to 150 years ago has either disappeared or is becoming more difficult to identify. In the extensive farming areas, the first settlers quickly erected fences or constructed roads along their common property lines. Thus, these lines have been perpetuated. In the more remote areas, the boundaries of lands taken up for stockraising or other nonintensive uses, while presumably identifiable by the original locator, have with the passage of years and ownerships become obliterated in many cases. This has come about because of the ravages of time, impermanent original monuments, natural destructive forces such as erosion, animals, and probably most important—the works of man. Since much of this category of land is intermingled public and private, it is becoming increasingly important for management and administrative operations to identify the boundaries of the public lands. The private landowner also benefits indirectly from these resurveys since the boundaries of his lands common with the public land are resurveyed and marked at the same time. The generally increasing value of real estate also contributes to the demand for resurveys.

A large number of special-purpose resurveys were made during the year in the extremely valuable timberlands for timber sale purposes and to detect and locate timber trespasses as a basis for either civil or criminal prosecution. Resurveys also were made to segregate locations under the mining laws to permit the surface use of the land under the land laws.

Cooperative projects with the Forest Service to remonument public land survey corners of the boundaries of the western national forests were well underway in fiscal year 1962. Under a cooperative agreement, Forest Service personnel search for original corner evidence which is inspected and examined on the ground by cadastral engineers who either accept or reject it. If accepted, the original corner evidence is perpetuated by the setting of a Bureau of Land Management stand-

ard brass-capped iron post. Such reestablishment is made a part of the official survey records.

A major and unique project that was successfully completed in fiscal year 1962 was the lower Colorado River cadastral survey project. Under this project, all public and acquired lands of the Bureau of Reclamation were surveyed along the Colorado River extending from the Mexican border to Nevada, some 150 miles. At the same time, some riparian surveys of Indian reservations were made for the Bureau of Indian Affairs. Extensive historical, geological, and local research and investigations were required to provide the background necessary to make these surveys. These surveys required the application of various legal principles and riparian techniques. Among other complications, they involved a determination of the nature and character of



Foreign experts in land and range conservation were guests of the Bureau of Land Management during a tour of forage improvement projects in Colorado. The visitors came from 10 new and developing nations.

the changes of the erratic Colorado River and were among the most difficult surveys to come before this Bureau.

Nearly 930,000 acres of resurveys were accepted during the fiscal year in addition to nearly 100 supplemental plats. Supplemental plats are those prepared from information available in the office and do not require fieldwork. They are constructed in most cases to provide a description and acreage of a tract of land which cannot be described by existing plats of survey.

Alaska Surveys

Only about 1 percent of Alaska's area of some 360 million acres has been cadastrally surveyed. While there are some rectangular surveys, most activity in Alaska prior to statehood was metes and bounds surveys of irregular tracts known as "U.S. surveys." However, with the advent of statehood and large congressional grants of public land to the new State, there has been an acceleration of survey activities in Alaska.

The land grants to Alaska provide that the State can select, in 25 years, either surveyed land or unsurveyed land in compact units, with minimum amounts of 5,760 acres, up to a total of more than 103 million acres. Consequently, survey operations in Alaska are directed principally to the survey of the areas of unsurveyed land selected by the State.

In view of the magnitude of the job and the physical characteristics of Alaska, every new modern surveying technique is being employed. Photogrammetry is the principal method of survey used for the survey of State selections, with electronic measuring devices also being employed. Helicopters are the standard means of transportation away from the few roads. In order to clear the title of lands selected by the State, an expanded program of the execution of U.S. surveys has been necessary. Since rights can be acquired by a valid location on the public lands, it is necessary that these locations be segregated by survey before the adjoining lands can pass to the State.

During fiscal year 1962, some 2¼ million acres of rectangular, State selection, and U.S. surveys were executed in the field, and 137,000 acres of surveys were accepted in addition to 29 supplemental plats.

Outer Continental Shelf

Six leasing maps of the Outer Continental Shelf off California, extending from Point Conception to the Oregon boundary, were published during the year. These maps extend seaward to depths of 600 feet and aggregate an area of 4 million acres. Leasing maps

are required for the leasing of any areas on the Outer Continental Shelf for mineral leasing purposes.

Construction

A branch of design and construction was established in the Bureau this year. The primary goal was the programing and development of civil engineering activities such as design and construction of resource development and conservation projects, access roads, buildings, and facilities, including recreation.

Wise use and conservation of the public lands and resources requires access to the areas of operation. Accordingly, access roads must be designed and constructed to serve the resources—varying from roads for heavy logging operations to roads needed for range management, recreational activities, and other resource management requirements.

A handbook has been published showing map symbols for use by all cartographic personnel in the preparation of maps made for Bureau-wide use in connection with resource management responsibility. These symbols will standardize as to feature, dimension, and characteristic all mapping symbols used in the Bureau.

Groundwork has been laid looking toward the standardization of buildings and facilities required in field operations and the standardization of contracting procedures for construction contracts.

Communications

During the year, communications were upgraded and a branch of communications engineering was established within the Bureau. The paramount aims were the programing and developing of communication systems to meet the Bureau's needs.

The initial goal was to increase personnel and equipment as far as funds permitted. One aim was to reduce unsupervised contractual maintenance service to a minimum and another to extend and improve communications coverage. An estimated 10-percent increase in coverage had been accomplished by the end of fiscal year 1962, while a large percentage of contractual maintenance service was replaced by civil service employees.

Considerable progress was made in the improvement of systems engineering. Standards were established in engineering with emphasis on equipment and better utilization of available radiofrequencies. The aim of such standards is to make more modern equipment available with some savings to the Government and to improve communications.

Research and development of equipment without any expenditure of funds was initiated and resulted in one model which included some

of the Bureau's recommended engineering being in use at the end of the year. Two other units of radio equipment which will better meet fire control needs are under discussion. One is intended to improve aerial fire control which has been handicapped in the past by the lack of frequency compatibility and by inadequate equipment.

Staffing

As of June 30, 1962, the Bureau of Land Management had 3,071 permanent employees, 314 of whom were at headquarters in Washington. At that time there were also 1,300 seasonal employees.

Permanent employees assigned to State, field administrative, and district offices were as follows: Colorado, 288; Montana, 180; New Mexico, 190; Wyoming, 180; Arizona, 125; Idaho, 174; Nevada, 167; Utah, 232; California, 271; Oregon, 642; and Alaska, 289. Reporting directly to the Washington office were the additional permanent employees: four with the Outer Continental Shelf office in Louisiana, three with the office in Minnesota, six field committee personnel in various Western States, and six auditors.

Finance

Total appropriations during fiscal year 1962 for operations of the Bureau of Land Management were: Management of lands and resources, \$34,575,000; construction, \$1,050,000; O. & C. grant lands, \$7,835,844; range improvements, \$739,842; and Public Lands Administration Act, \$463,645.

During fiscal year 1962 the Bureau of Land Management received from the sale and management of public lands and resources a total of \$173,517,502. These receipts came principally from mineral leases and permits; timber sales; sales of public lands and materials; grazing leases, licenses, and permits; fees and commissions; and leasing of rights-of-way.

Receipts of the Bureau of Land Management for fiscal year 1962 were distributed as follows: \$61,533,133 to 27 public land States, of which \$15,400,136 went to the 18 western Oregon timberland counties; \$59,117,434 deposited to the reclamation fund; \$48,128,179 to the general fund of the Treasury; \$3,794,200 transferred to other Government agencies; \$248,031 earmarked for Indian trust funds; and \$696,525 returned to the grazing districts for range improvements.

Grand total of all receipts of the Bureau of Land Management and its predecessor agencies is \$2,596,530,333. Since 1946, when the Bureau of Land Management was established, receipts total \$1,859,885,180.

National Park Service

Conrad L. Wirth, *Director*



Enjoyment of A Heritage; Protection of A Legacy

At the White House Conference on Conservation last spring, President John F. Kennedy said: "I don't think there is anything that could occupy our attention with more distinction than trying to preserve for those who come after us this beautiful country which we have inherited."

In the spirit of this message, and during a year in which Secretary of the Interior Stewart L. Udall called for a national conservation effort "to secure an adequate resources base for the future, and to plan the use of our land resources so that material progress and the creation of a life-giving environment will go hand in hand," the Department's National Park Service:

- Established a close working relationship with the new Recreation Advisory Council and the recently established Bureau of Outdoor Recreation in the common mission to bring about improved interagency cooperation and to develop coordinated national outdoor recreation policies.

- Saw three new areas added to the National Park System: Cape Cod National Seashore, Massachusetts; City of Refuge National Historical Park, Hawaii; and Buck Island Reef National Monument near St. Croix in the Virgin Islands.

- Recorded over 82,300,000 visits to national parks and related areas, representing an increase of 8.6 percent over the previous year.

- Observed a 4.4-percent increase in camping, with over 5,051,000 camper days recorded.

— Entered into a contract with the National Academy of Sciences, initiating a study of natural history research needs of the national parks. The Academy, on the basis of its findings, will advise and make recommendations for a research program designed to provide data for effective protection, management, development and interpretation of the national parks, and to encourage greater use of the national parks for basic research.

— Constructed 9 new visitor centers and installed 16 new museums in parks throughout the country—permitting a better program of interpretation.

— Continued efforts to round out a National Park System that will be adequate in meeting the needs of the Nation—now and in the future—with major emphasis and priority on Secretary Udall's campaign to preserve some of America's few remaining undeveloped natural areas along seashores, lakeshores, and free-flowing streams.

— Was tremendously encouraged by President Kennedy's special message on conservation urging the Congress to take "favorable action on legislation to create Point Reyes National Seashore in California; Great Basin National Park in Nevada; Ozark Rivers National Monument in Missouri; Sagamore Hill National Historic Site in New York; Canyonlands National Park in Utah; Sleeping Bear Dunes National Lakeshore in Michigan; Prairie National Park in Kansas; Padre Island National Seashore in Texas; a National Lakeshore Area in Northern Indiana; and Ice Age National Scientific Reserve, Wisconsin."

— Worked with the Department's other agencies in support of the broad principles of wilderness legislation now before the Congress.

— Cooperated in advanced planning in anticipation of the passage of youth employment legislation which would establish a Youth Conservation Corps designed to offer outdoor employment in the Nation's parks, forests, and other public lands.

— Stepped up its Mission 66 park improvement program.

— Completed a 5-year survey of existing and potential parks and related types of recreation areas. In a State-by-State investigation conducted in cooperation with the States, 4,800 existing and 2,800 potential parks and recreation areas were identified. These findings were turned over to the Department's Bureau of Outdoor Recreation.

— Increased the use of helicopters to provide better administration, maintenance and protection, especially in mountainous and otherwise inaccessible back-country areas where this type of equipment offers the only fast and reliable methods for emergency

rescue missions, combating forest fires and other forestry work such as control of insect infestation and disease.

— Participated in the Federal and State aerial reconnaissance of storm damage in six States following the disastrous storm of March 6 and 7, 1962, along the Atlantic coast. Shore damage along the barrier beaches was particularly severe at shorefront developments of Atlantic seashore resorts. The Service published a report which explored the question of dedicating shoreline portions of barrier beaches to public use and recommended various means for prevention of the recurrence of such devastation to private property along barrier beaches in the future.

— Welcomed the addition of more women to the uniformed staff of the National Park System as interpretive specialists.

— Cosponsored the First World Conference on National Parks, Seattle, Wash., June 30–July 7, 1962, in cooperation with the International Union for the Conservation of Nature and Natural Resources (IUCN), the Natural Resources Council of America, and other United Nations organizations and Federal agencies. Representatives from 63 foreign countries were guests of the National Park Service at Mount Rainier, Olympic, Yellowstone, and Grand Teton National Parks.

— Placed special emphasis during the year on interpretive work in Civil War areas of the National Park System to meet the impact of increased visits engendered by Civil War centennial observances sponsored by State and local organizations. Many special exhibits were prepared in visitor centers of the National Park System, and the Service cooperated in many special commemorative programs such as the reenactment of the Battle of Manassas.

Public Affairs

The National Park System preserves physical evidences of the growth of a magnificent and fruitful Nation. It is no wonder—as we come increasingly to grips with the pressures of our modern world—that Americans turn to their heritage for a renewal of spiritual strength and pioneering determination.

Today, Americans are crowding the highways and visiting the parks and recreational areas of the country as never before in history. Yearly visits to the national parks have leaped from 22 million only 15 years ago to more than 80 million last year—and the demands of the public for information about the places they visit have increased in the same ratio.

A new emphasis toward meeting the needs of American and foreign friends visiting the national parks is evidenced in the interpretation of these areas through audiovisual services, museums, visitor centers, informative publications, guided trails, and campfire talks.

Emphasis has also been placed on keeping up with the demands for photographic services to supply the requirements of newspapers, magazines, television, and other public relations media.

Our responsibility is not only to the millions who visit the parks, but also to the many more millions who are unable to see the wonders themselves and must rely on the printed word and pictures.

Publication and Service Programs

Emphasis to date in the publications program has been to produce folders on each of the respective areas of the National Park Service. But more and more, Americans are demanding additional informational material. In 1962, the Service printed 4,409,000 copies of 165 free informational publications for the various areas, plus 145,000 copies of 5 general free informational publications. The present publications program provides approximately one folder for every six visitors.

A Division of Extension Services was established during the year to provide staff guidance and assistance in connection with Service-sponsored special public events, dedications, observances, and meetings, as well as Service participation in public meetings sponsored by other organizations. The Division also provides liaison services with conservation and education groups, universities and schools, and is responsible for developing and carrying out public information programs for needed park resources protection measures.

Requests for National Park Service photographs rose 40 percent during the year, mirroring the interest in Secretary Udall's proposals for new areas for the National Park System. More than 10,000 prints of photographs were loaned upon request for use by various information media and in educational programs.

Audiovisual

The trend toward greater use of audiovisual devices in the interpretive and educational program of the Service accelerated tremendously. Included in the year's accomplishments were:

- the completion of 10 amphitheaters,
- installation of 51 audio stations,
- installation of 17 automatic slide/sound projection systems in visitor centers,

- installation of public announcement systems in four visitor centers,
- addition of 17 cabinet projector installations utilizing captioned slides,
- construction of two automatic electric maps with synchronized sound,
- equipping of two visitor center auditoriums for “live” presentations,
- improvement of the program for five existing installations.

Park interpretation in foreign language continued. A captioned slide presentation in the Spanish language was installed alongside a similar English version at San Juan National Historic Site, Puerto Rico. The enthusiastic reception being given the foreign language tape recordings by foreign visitors to the Liberty Bell in Independence Hall, Philadelphia, suggests that such service for foreign visitors should be considered for other areas as well.

International Cooperation

A Division of International Cooperation was established in response to the growing interest of foreign visitors in America's national parks—evidenced, during the year, by 2,100 letters of inquiry from abroad and by more than a thousand foreign visitors who were received by or had made personal contact with various staff members of the National Park Service.

In cooperation with the International Union for the Conservation of Nature and Natural Resources (IUCN), the Natural Resources Council of America, and other United Nations organizations and Federal agencies, the National Park Service cosponsored the First World Conference on National Parks held in Seattle, Wash., June 30–July 7, 1962. The meeting, which had as its theme, “National Parks Are of International Significance,” was attended by more than 300 professional park people representing some 63 nations throughout the world.

The basic purpose of the meeting was to further international coordination of world conservation efforts and to encourage further the establishment of new parks and reserves throughout the world.

Conservation, Interpretation, and Use

The Service reorganization during the fiscal year brought about a gathering of staff divisions concerned primarily with actual park operational activities into a single organizational group under the

supervision of Assistant Director of Conservation, Interpretation, and Use. This brought into close association the interrelated functions of maintenance, protection, interpretation, visitor use, research, and resource management.

Conservation Activities

A major objective common to most legislation related to the National Park Service places emphasis on preservation from injury and spoliation; conserving the scenery and the natural and historic objects and the wildlife therein for the benefit and enjoyment of the people now and in the future.

Conserving these values and assuring the welfare of park visitors required positive protection and carefully regulated use.



This bull elk died from starvation in Yellowstone National Park. The calf in the background is only hours away from death. Overpopulation of elk in the park destroyed the vegetative cover and opened the range to heavy erosion. Quick action in reducing elk populations strengthened the herd and protected park values.

Forests, Soils and Water

Forest fire control efforts reached an alltime high in fiscal year 1962. Alert and trained fire crews and the expanded use of aircraft achieved early control of many fires under hazardous conditions. In the first half of 1962 drought conditions prevailed in the Southeast. Halfway through its fire season by the end of fiscal year 1962, Everglades National Park had 20 fires, almost double the 10-year average of 11 fires. The Shark Valley fire in Everglades, largest fire in Service history and originating outside the park, burned from May 15 to June 20, 1962, over an area of 184,544 acres—77,664 acres of this was parkland. Major control projects were conducted to combat outbreaks of western pine beetles in Lassen Volcanic, Yosemite, Sequoia, and Kings Canyon; mountain pine beetles in Grand Teton; lodgepole pine needle miner in Yosemite; and gypsy moth in Acadia. Programs for control of white pine blister rust through eradication of the alternate host and the use of antibiotics were continued in 10 parks.

Soil and water conservation measures to restore deteriorated lands were carried out in 20 parks. Management controls were increased to prevent destruction of fragile meadows and vegetative cover types in the high mountains. Range grazing was reduced by 800 animal unit months in the western parks. An AUM (animal unit month) is based on the amount of food (grazing) required to feed one cow or five sheep for 1 month in a particular location, which may vary in carrying capacity, and which, in turn, depends upon climate, soil, and other growing conditions. The total grazing in 18 parks was 85,342 AUM's. Pasturing to maintain scenes in historical parks required 24,209 AUM's.

Wildlife

There are very few places in the world today other than in national parks where opportunities are available for the public to observe and photograph wildlife under natural conditions. To insure that public enjoyment continues, wildlife management programs are directed at attaining an optimum relationship between all animals consistent with the native flora and in harmony with the conservation of other park values.

Increased bear-management programs this year resulted in a significant reduction of personal injuries and property damage to the visitors. Studies of both grizzly and black bears continued in Yellowstone.

Studies at Grand Teton National Park resulted in recommendations for an elk-management program in portions of that park. Public hunters were deputized to participate in the 1961 program under the



Wildlife management programs of the National Park Service are directed at attaining an optimum relationship between all animals consistent with the native flora and in harmony with the conservation of other park features. In Everglades National Park, Fla., above, one can see and photograph alligators in their natural habitat.

provisions of Public Law 787 and removed 278 elk. Cooperative elk studies with State and other Federal agencies were developed in Rocky Mountain and Yellowstone National Parks.

Other elk-management programs were conducted in Yellowstone, Glacier, and Rocky Mountain. The outstanding management program for the year was the successful removal of 4,555 elk from the northern Yellowstone elk herd by park rangers. The overpopulation of elk had already driven out two other species, the beaver and the whitetailed deer.

Acadia, Grand Canyon, Mammoth Cave, and Sequoia and Kings Canyon carried on limited deer-management programs. Wind Cave, Yellowstone, and Grand Teton disposed of 237 surplus buffalo. Death Valley, Lake Mead, Great Smoky Mountains, and Hawaii Volcanoes conducted management programs directed at control of feral burros, pigs, goats, and boars.

Fishery studies were carried on in cooperation with the Department's Fish and Wildlife Service in Yellowstone, Rocky Mountain, Mount Rainier, Olympic, and Isle Royale. Seventeen areas carried on stocking programs.

Interpretation Activities

The values and purposes of the national parks were explained to an increasing number of visitors by the addition of new visitor centers, roadside and trailside signs and facilities, publications, and personnel.

In recognition of an obligation to provide equal opportunities for women, the Service welcomed the addition of more women this year to the uniformed staff of the National Park System as interpretive specialists.

A new venture began with authorization of sound and light programs for Independence Hall in Philadelphia and for Castillo de San Marcos National Monument in St. Augustine, Fla. Modeled after the spectacular night programs presented first at the Castle of Chambord and Palace of Versailles in France and now widely given throughout Europe, they offer a dramatic presentation of history, using controlled light and recorded stereophonic sounds, narrative, and dialog. The first such program in this country began at Independence Hall on July 4, 1962, followed by that at the Castillo later in the summer.

Visitor Centers

Nine new visitor centers were opened: Big Bend National Park, Tex.; Petrified Forest National Monument, Ariz.; Great Sand Dunes National Monument, Colo.; Homestead National Monument, Nebr.; Fort Donelson National Military Park, Tenn.; Gettysburg National Military Park, Pa.; Saratoga National Historical Park, N.Y.; Fort Vancouver National Historic Site, Wash.; and Natchez Trace Parkway, Mississippi, Tennessee, and Alabama.

Exhibit Installation

Sixteen parks installed museums—seven in new visitor centers, five in enlarged or remodeled ones, and four in existing buildings. More than 300 exhibits were installed in visitor center museums from coast to coast to help interpret the varied stories our parks have to tell.

An example is the remodeled center in Fredericksburg, Va., which shows how a Confederate officer lived during a hard winter of the Civil War, complete with folding camp cot, writing desk and other paraphernalia of the period. In the new visitor center at Great

Sand Dunes, an exhibit uses animated diagrams to show how sand moves to form the dunes.

Another, at the Homestead center, features a unique cold-roller mangle which used large rocks to provide the weight needed for the pioneer mother to iron the family wash. A slide-sound program accompanies the machine to explain how she used it. Eight scale dioramas, from Saratoga, N.Y., to Fort Vancouver, Wash., capture some of the great moments in our history.

The Service participated in the White House Historical Association program by working with the Smithsonian to provide exhibits on the development of the Executive Mansion.

Museum Collections

Parks have added many fine Museum specimens. These include a rare German astrolabe by Johann Krabbe, dated 1582, donated to the collections of Fort Caroline, Fla.; an outstanding group of Spanish arms added to the holdings of Tumacacori, Ariz.; military uniforms and flags from the Spanish Army Museum for Castillo de San Marcos, Fla.; and two Congressional Medals of Honor for display at the Chancellorsville and Stones River, Tenn., centers.

The Service has continued its program of preserving specimens, paintings, and furnishings in the collections of the parks. It completed one of the largest such projects undertaken, the painstaking restoration and rehanging of the famed Gettysburg Cyclorama in the new visitor center. The magnificent painting, 353 feet in circumference and 27 feet high, serves as the centerpiece for an inspiring program, supported by sound effects and an inspirational narrative.

Roadside and Trailside Interpretation

Roadside interpretive facilities were developed or substantially improved in 17 scenic-scientific parks and in 16 historic ones. The installation of interpretive signs, markers, and trails along the Tioga Road in Yosemite typifies effective "self-service" interpretation along park roads.

Coordinated planning with Service architects and landscape architects has produced the Lee's Hill Shelter panels, Fredericksburg, Va., and the High Water Mark Tour exhibits, Gettysburg, Pa. Greater use of more durable materials, like metal photos, brought encouraging results in on-site exhibits.

While self-service interpretation was improved and expanded on a wide front, the program of conducted trips and talks was also increased. In Yosemite National Park, naturalist-led High Sierra 7-day hikes were resumed after 20 years. Permanent and seasonal interpretive



Secretary of the Interior Stewart L. Udall examines a statue of Theodore Roosevelt with Oscar Strauss, president of the Theodore Roosevelt Association, at the Roosevelt Birthplace, New York City. The building is an area recommended as a national historic site.

staffs were enlarged and 13 new amphitheaters and campfire circles were completed, resulting in an expansion of evening programs in parks where visitors stay overnight.



An astrolabe made, signed, and dated by Johann Krabbe in 1582, was recently acquired by the National Park Service. An unusually fine specimen containing much astronomical detail, it is believed to be the only 16th century astrolabe in the Western Hemisphere heavy enough to have been used for navigation. Purchased and donated anonymously, it will be exhibited at Fort Caroline National Memorial, Fla.

Historic Houses

The House of Representatives in Congress Hall, Independence National Historical Park, Philadelphia, has been refurnished to the period of the 1790's when it resounded with the debates of legislators of a young nation. A Federal eagle, painted on the ceiling of the Senate Chamber in Congress Hall, painstakingly removed last year, has been restored and replaced.

The restoration program of Fort Laramie, Wyo., has continued with the refurnishing of the Sutler's Store and a second officers' quarters.

Cooperating Associations

Some 53 nonprofit cooperating associations contributed \$169,941 for aid to the National Park Service for research, equipment, books, and materials used in the interpretive program. These associations produced 29 new publications for sale in the areas. A full-color publication, "Jamestown to Yorktown From Settlement to Nationhood," has won two national awards. "History of the United States Flag" has received national recognition. Both were produced by the Eastern National Park & Monument Association. "Mammals of the Southwest Mountains and Mesas," was published by Southwestern Monuments Association.

Research Efforts

Historical research studies, 46 in all, were completed during 1962 by Service historians. "Puerto Rico and the Elizabethan Age: An Historical Analysis of the Attack by the Earl of Cumberland Against the Island of Puerto Rico," expanded our knowledge of San Juan National Historic Site. Other notable studies covered such subjects as restoration of the Russian Blockhouse at Sitka, Alaska; General Andrew Jackson's "Mud Rampart" defense line at the Battle of New Orleans. Twenty-two studies relating to the Civil War were completed during its second centennial year and included a study of "Clara Barton at Antietam."

Two historians were sent to Spain during the year to procure historical data from Spanish archival sources and to purchase, in part with donated funds, historic objects and specimens needed for museum purposes at San Juan, Castillo de San Marcos, and Fort Raleigh.

Archeology

Archeological research was carried on in 31 areas of the system, the largest program to date. Major projects were initiated at Cape

Cod, Chesapeake and Ohio Canal, and others continued at Acadia, Grand Portage, Independence, and Hopewell Village. Historical archeology conducted in seven areas supplemented and verified historical records. Historic objects were found in some primarily prehistoric sites, as at Ocmulgee, filling in knowledge of early European contact with the Indians. At Isle Royale, a survey is providing important data on aboriginal and early historic sites.

The Service has been vigilant to prevent destruction of archeological remains that might be lost through construction in areas of the system. During the year a major salvage project was initiated at Ocmulgee where Interstate Highway 16 will cross the monument. It was financed by the State of Georgia at a cost of \$155,000, reimbursed by the Bureau of Public Roads.

The Wetherill Mesa project passed the halfway point. Mine sites which present a thorough coverage of the Indians who lived at Mesa Verde are being excavated. For the fourth year, the National Geo-



Archeologists salvage prehistoric artifacts and scientific information from a 5,000-year-old Indian campsite near the new Red Willow Dam in Nebraska, while cooperative construction crews work around them to shape the new reservoir basin.

graphic Society donated \$50,000. It is one of the major endeavors of New World archeology, matching in scope, duration, and financial support the most ambitious past undertakings.

Salvage Archeology in River Basins

The Service continued its extensive salvage program in reservoir areas with the cooperation of Federal, State, and local organizations. There were 62 salvage projects in 35 States with 34 cooperating institutions. The Smithsonian Institution had 3 field parties in the Missouri River basin in the fall, and 16–18 work crews for the season beginning June 1962.

The University of Utah, Museum of Northern Arizona, University of Colorado, and Museum of New Mexico cooperated with the Service on the Upper Colorado River project, conducting surveys and excavations in Glen Canyon, Fontenelle, Flaming Gorge, and Navajo Reservoirs, and the Blue Mesa unit of the Curecanti project.

The University of Texas excavated in Amistad (Diablo) and McGee Bend Reservoirs and surveyed Toledo Bend, Columbus Bend, and Livingstone. Work continued at John Day Reservoir by the University of Oregon, and at Walter F. George Reservoir by the Universities of Georgia and Alabama.

Natural History

Secretary Udall secured the assistance of the National Academy of Sciences in planning and further broadening the National Park Service's proposed comprehensive research program. A new comprehensive natural history research program for the national parks—endorsed by the Secretary's Advisory Board on National Parks, Historic Sites, Buildings, and Monuments—was launched, under which the Service considers research as a comprehensive system-oriented program rather than a piecemeal, problem-oriented series of projects. Since knowledge obtained through research is equally important to protection, development, park use, wildlife management, and interpretation, the new program will include periodic reappraisals of ecological conditions to determine whether changes are needed in management practices, to identify and correct ecological damage before it can reach an irreversible stage, and to ascertain the need for additional specific research.

To assist in carrying out these objectives, the Academy, in cooperation with the Department of the Interior, selected an advisory committee of the country's leading scientists.

The biological research program produced two outstanding books: "A Naturalist in Alaska" and "The Bighorn of Death Valley." The

latter publication is a revival of the National Park Service Fauna Series on natural history research.

Outstanding progress was made in research on the interrelationships of wolf, beaver, and moose at Isle Royale. Cooperative research in the Yellowstone Lake fisheries and marine research in the Virgin Islands were completed.

An analysis of water-supply needs for preserving the ecology of Everglades National Park was undertaken by the University of Miami, which also continued its research into the dependence of commercial fish populations on park waters. Another research project showed that tree invasions of meadows on the floor of Yosemite Valley are natural, unlike forest invasions at higher altitudes which other research has shown to be caused by human interference.

Progress continued on studies of the survival and natural propagation requirements of the Giant Sequoia and on the ecological requirements of the rare Kaibab squirrel in Grand Canyon. In Grand Teton and Yellowstone, in cooperation with the Montana Cooperative Wildlife Research Unit, transistorized radio transmission sets were attached by collars to grizzly bears to trace their activities.

Extensive geological research was accomplished in the national parks. Studies of hydrothermal features and phenomena in Yellowstone, which were stepped up following the Hebgen Earthquake of 1959, were continued in cooperation with the Department's Geological Survey.

Excellent progress was made on continuing or recurring projects including glacial studies in Glacier, Mount Rainier, Olympic and Sequoia and Kings Canyon; volcanological investigations in Hawaii volcanoes; and studies of geology and ecology at Great Sand Dunes.

The Department has approved a program of identification, evaluation, selection and registration of nationally significant geologic and ecologic sites.

Ruins Stabilization

Ruins stabilization crews from the Southwest Archeological Center worked in eight sites. The Wetherill Mesa project did stabilization in conjunction with excavation. Other stabilization at Mesa Verde included the spectacular pinning of a free-standing arch to the cliff above Spruce Tree House, and the digging of a 300-foot tunnel under Cliff Palace to drain excessive moisture.

Historic Sites, Buildings, and Landmarks

Substantial progress was made in the National Survey of Historic Sites and Buildings, which completed the following studies: "Political



A National Park Service archeologist views a mass display of prehistoric Indian pottery recovered from the Wetherill Mesa excavations at Mesa Verde National Park. Study and analysis of these artifacts will shed new light on the life of Indians who made them.

and Military Affairs, 1830-1860", "Transportation and Communication", and "Dutch and Swedish Exploration and Settlement." To date, 23 studies have been completed, leaving 17 to be done. Of these, nine are underway. A volume entitled "Road to Revolution: Virginia's Rebels from Bacon to Jefferson, 1676-1776" was published.

By the end of the fiscal year, 311 sites were classified as possessing exceptional value and eligible for registered national historic landmark status. Under the registry, 179 certificates and 77 bronze plaques have been issued. The landmark program has been enthusiastically received by the public, with formal ceremonies being held in connection with the majority of certificate and plaque presentations. In a number of cases, such as Graham Cave in Missouri and Fort Robinson, Nebr., landmark status has expedited or encouraged acquisition of sites by States or preservation organizations for public use. This is one of the purposes of the registry.

Visitor Use

The National Park Service is emphasizing the need to protect park values rather than relying only on the rigid enforcement of laws.



Civil War reenactments and exhibits were part of the interpretive work in the Civil War areas of the Park Service during the first year of the Civil War centennial observances. The first reenactment took place at Manassas National Battlefield Park, Va., on July 21, 1961.

This emphasis contributes to visitor enjoyment and accomplishes the protective function in a manner that creates a "park atmosphere." No one likes to go to an overregulated park. However, protection against vandalism and other violations which damage the parks for future users is always necessary.

The numerous facets of ranger activity assignments require specialized emphasis on such subjects as visitor protection, forest and structural fire control, safety of park visitors and park employees, search-and-rescue techniques, wildlife management, law enforcement, and mountaineering.

Training

Training of ranger services and supporting personnel at all levels in the skills of park and visitor protection, wildlife management, and emergency operations were expanded and involved more than 2,000 individuals.



New visitor centers were constructed in nine National Park Service areas. One of these was dedicated at Homestead National Monument, Nebr., on June 10, 1962.

The training center at Yosemite provides two 3-month courses each year for newly appointed uniformed employees. The curriculum includes Service history, policies, objectives, organization, and field operations. Initiated in 1957, it has graduated 254. In 1963, the training center will move to a special facility now under construction at Grand Canyon.

Cooperation

Cooperation with Federal and other organizations has been expanded in relation to park use. Primarily concerned were activities relating to water recreation, law enforcement, regulations, mountaineering, winter use, camping, conservation and preservation of resources. Two park rangers toured seven European countries as part of a team in promoting the "Visit USA" program. Millions of Europeans learned something of the significance of the National Park System and were invited to enjoy with the people of the United States these areas of national and international interest.

Ranger services in cooperation with other Federal bureaus organized, coordinated, and conducted a pilot field program for 10 African college students. These students, potential leaders of new African nations, were acquainted with the principles of resource conservation and management as practiced by the Department.



The National Park System preserves outstanding scenic, scientific, and historic areas of the Nation "for the present and future generations." Olympic National Park's Delabarre Glacier, above, is an outstanding example of preservation of a scenic area.

Concessions Activities

Concessioners in several areas invested substantial amounts in expanding and improving their overnight accommodations and rehabilitating existing facilities. The most important improvements

were made by the concessioners as follows: South Rim of Grand Canyon, \$372,000; Sequoia and Kings Canyon, \$101,000; Shenandoah, \$144,000; and Yosemite, \$351,000. Projects by the concessioners are either under way or being planned in Big Bend, Everglades, Mammoth Cave, and Olympic National Parks, on the Blue Ridge Parkway, and in Lake Mead National Recreation Area.

The District of Columbia Stadium, on lands administered by the National Park Service, was dedicated and placed in use during the year. The stadium is managed by the District of Columbia Armory Board under contract with the Department of the Interior.

Concession facilities at Cape Hatteras, which were demolished by Atlantic tidal storms, have been reconstructed and restored to service.

National Park Concessions, Inc., was granted a new 20-year contract for continued operations in Mammoth Cave, Big Bend, Isle Royale, and Olympic National Parks, and the Blue Ridge Parkway. Under the terms of this contract, the company will invest \$3 million in new and improved facilities at these areas. In addition, contracts were entered into with concessioners at Fort Sumter, Glacier, and Lake Mead. Three prospectuses were issued inviting offers in connection with concessions at Fort Jefferson National Monument, and Hot Springs and Great Smoky Mountains National Parks.

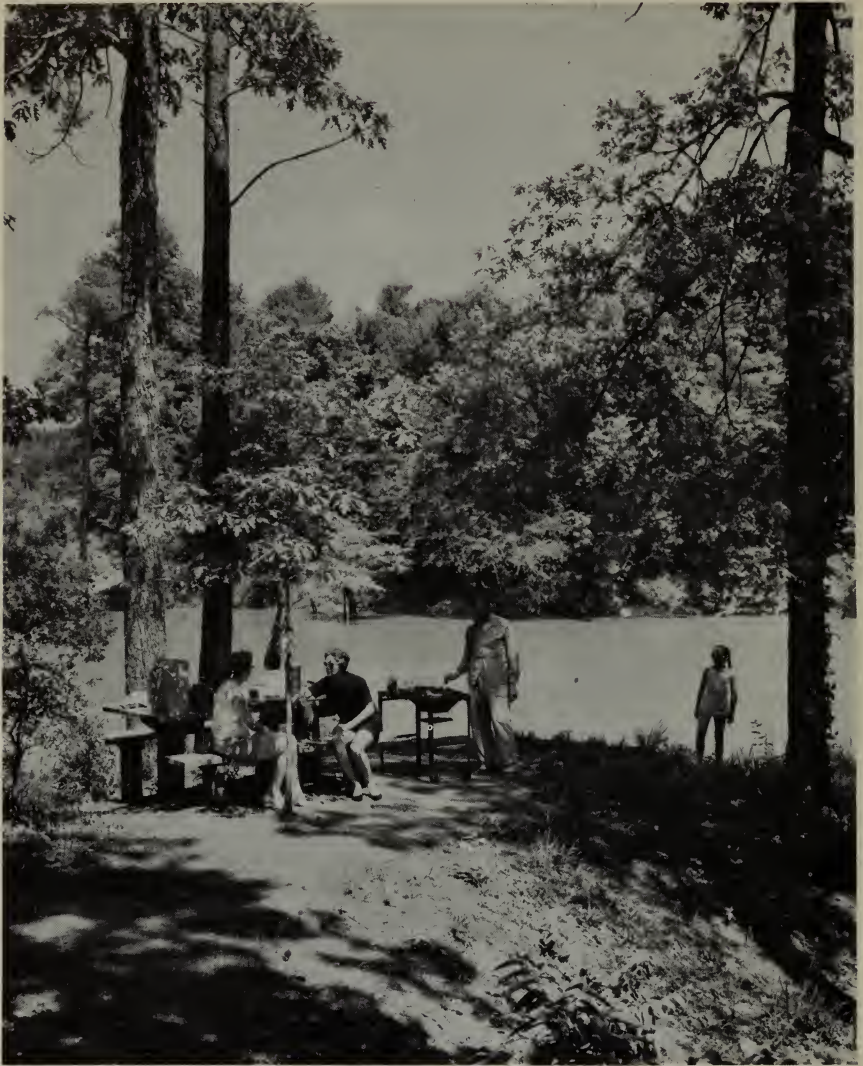
Operations and Maintenance

New maintenance techniques have been employed. A new type rotary snowplow at Yellowstone, in its first year of operation, gave a highly satisfactory performance. New mobile highway lane stripers in areas with highspeed roadways, have reduced costs and discomfort. Hazardous trees are being removed in public areas in Yosemite, Bandelier, Sequoia, and park areas in our Nation's Capital. By using up-to-date research and management techniques, costs are reduced and the esthetic enjoyment of the visitor is increased.

To accommodate the campers, hikers, and wilderness enthusiasts, a back-country cleanup program is underway at Sequoia, and lake-shore cleanup is progressing nicely at Coulee Dam.

Safety

Calendar year 1961 was one of the most successful on record both in accident reduction and program effort. Two outstanding accomplishments were: First, the great reduction in accidental deaths to National Park Service, concessioner and contractor personnel working in the parks. The past average of 13 workers (including 3 Service employees) killed by accidents on the job each year was reduced to a



Picnicking and camping are pleasant interludes for travelers on parkways administered by the Park Service. Natchez Trace Parkway, Tenn.-Ala.-Miss., contains 450 miles of roads and offers many picnicking and camping areas.

total of 3 fatal accidents in 1962, 2 of these being contractor employees and 1 a Service employee. Prior to the one fatal accident, the Service had compiled a record of 22 consecutive months without a fatal accident to a Service employee. Second, the direct dollar loss or cost to the Service from accidents was reduced \$283,000, or ap-

proximately a 61-percent improvement as compared to the annual average loss total of previous years.

Park and Recreation Planning

The National Park Service's park-planning program is designed to expand the National Park system by selecting for preservation—while still available—those outstanding scenic, scientific, and historic areas of the Nation which are of national significance so that future park needs may be fulfilled. Although the Department's Bureau of Outdoor Recreation is taking over the principal recreation planning for the Nation, the National Park Service still requires its own planning operation for areas which it administers or plans to administer.

This program made significant progress during the year. Field investigations of approximately 60 areas throughout the country—which had been suggested for possible national park, national historic site, or national recreation area status—were conducted during the year. Comprehensive planning studies—such as specific area studies, economic studies, or land-use studies—were made of more than 20 areas to determine their national significance and their suitability and feasibility for inclusion in the National Park System. Among these were Florissant Fossil Beds, Colo.; Poverty Point, La.; Saint-Gaudens, N.H.; Big Horn Canyon, Mont.-Wyo.; Pecos, N. Mex.; and Baltimore. & Ohio Railroad Museum, Maryland.

Illustrated brochures—printed with private donations—were issued this year to describe the proposed Canyonlands National Park, Utah; Ice Age National Scientific Reserve, Wis.; Prairie National Park, Kans.; and Sleeping Bear National Seashore, Mich.

The Department is supporting legislation to authorize the establishment of the following areas: Chesapeake & Ohio Canal National Historical Park, Md.; Fort Bowie National Historic Site, Ariz.; Mount Vernon-Woodlawn Extension, George Washington Memorial Parkway, Va.; Great Falls Park (part of National Capital Parks System), Va.; and Hubbell Trading Post National Historic Site, Ariz. The Department also endorsed a study of a proposed Allegheny Parkway which would extend from Hagerstown, Md. to Cumberland Gap National Historical Park. In addition to the above-named areas, legislation was introduced in the 87th Congress to authorize the establishment of the following areas: Boston National Historic Sites, Mass.; Fort Larned National Historic Site, Kans.; Golden Spike National Monument, Utah; Oregon Dunes National Seashore Recreation Area, Oreg.; Pictured Rocks National Lakeshore, Mich.; Tocks Island National Recreation Area, Pa.-N. J.; Valle Grande National Park, N. Mex.; and Whiskeytown National Recreation Area, Calif.



Buck Island Reef National Monument near St. Croix, V.I., was one of the three new areas added to the National Park System during fiscal 1962. This area saves delicate coral formations and marine life from dangers of commercial fishing, spear fishing, and shell and coral collecting activities.

Areas Authorized or Established

Three new areas were established and six areas authorized for addition to the National Park System during the year.

A unique area, the City of Refuge National Historical Park in Hawaii, was established on July 1, 1961, to commemorate the sacred grounds where—until 1819—the vanquished Hawaiian warriors, the oppressed, and the taboo breakers could find protection and a haven.

One of the finest marine gardens in the Caribbean is now protected in the Buck Island Reef National Monument, near St. Croix, V.I., which was established by Presidential proclamation on December 28, 1961.

On August 7, 1961, Congress authorized the establishment of Cape Cod National Seashore. This act was a landmark in park legislation since it authorized \$16 million for land acquisition—the first time

Congress has authorized the appropriation of funds to acquire lands initially for a major scenic area of the National Park System.

Five new historical areas were authorized by Congress this year. Fort Davis National Historic Site in Texas, the site of a famous frontier fort, was authorized on September 8, 1961. The Fort Smith National Historic Site in Arkansas, authorized by the act of September 13, 1961, will commemorate the two successive forts located on this site to maintain peace among the several Indian tribes of this region from 1817 to 1871.

Piscataway Park, planned to be a part of the National Capital Park System, will preserve the Maryland shoreline of the Potomac River which contains the historic vista and scenic environs of Mount Vernon, the George Washington Memorial Parkway and Fort Washington. This area was authorized for acquisition by the act of October 4, 1961.

Another area honoring Abraham Lincoln, the Lincoln Boyhood National Memorial in Indiana, was authorized on February 19, 1962. Also, Alexander Hamilton will be honored by the preservation of his home in New York City. Authorized by the act of April 27, 1962, this building will be moved to the campus of the City College of New York and be designated Hamilton Grange National Memorial. Each of these five areas will be officially established when the Federal Government has acquired the required lands.

Boundary Adjustments

Legislation has been enacted during this year which authorized additions of lands at Cumberland Gap National Historical Park, Fort Raleigh National Historic Site, and Lassen Volcanic National Park; additions and deletions at Wupatki National Monument; and both boundary revisions and name changes for Fort Necessity and Tupelo National Battlefields.

By Presidential proclamation, 14,720 acres of public lands were added to Saguaro National Monument, and 375 acres were added to Gila Cliff Dwellings National Monument.

Legislation also authorized the disestablishment of the Ackia Battleground and Meriwether Lewis National Monuments and their inclusion in the Natchez Trace Parkway. These areas are now known as the Chickasaw and the Meriwether Lewis units of the parkway.

Planning for Nonurban Parks and Recreation Areas

A 5-year survey was completed on existing and potential parks and related types of recreation areas to meet future needs. The survey consisted of a State-by-State investigation, conducted in

cooperation with the States, and identified about 4,800 existing and 2,800 potential parks and recreation areas which could help to meet present and future outdoor recreation needs. Such cooperative nationwide planning will hereafter be the responsibility of the Department's Bureau of Outdoor Recreation.

Economic Research

Economic research during the year focused on measurement of the impact of proposed parks on the basic economic structure of an area and on the comparative effects on the economy and on the general welfare if natural resources are used for recreation development or for alternative uses.

A study was made by the University of Utah for the Service to determine the economic impact which might be expected to result from the establishment of the proposed Canyonlands National Park and to investigate the probable future growth of visits to the existing concentration of parks and monuments located within the region of the proposed park. A study was completed also on the economic feasibility of the proposed Sleeping Bear National Seashore.

A study of the recreation resources of northeastern Vermont was initiated to determine the economic feasibility of developing the recreation potential of that area. A prospectus for the study was developed and a contract negotiated with the University of Vermont.

Urban Open Space

The Service assisted in the preparation of a joint report by the Department of the Interior and the Housing and Home Finance Agency on a long-range program and policy for open space and orderly development in urban areas. The Service also maintained liaison with the Housing and Home Finance Agency on the program of grants to States and local public bodies for the acquisition of open-space land in urban areas, established under the Housing Act of 1961.

Special Studies

A 3-year study of reservoir recreation potentialities in the Potomac River basin was completed, with funds provided by the Corps of Engineers. Work was undertaken, also at the request of the Corps of Engineers, on a 3-year study of the park and recreation area potential of proposed reservoirs in the Ohio River basin.

A report on Puerto Rico's recreation resources was completed under contract. Fieldwork was completed on a seashore and park study of Hawaii.

Following the disastrous storm of March 6 and 7, 1962, along the Atlantic coast, which caused severe damage along the barrier beaches of six States, the Service assisted in the organization of a task force of Federal and State agencies to make an aerial reconnaissance of the shorelines of the six States and published a report, "Seashore Preservation and Recreation Opportunities and Storm Damage." The report explored the question of dedication of shoreline portions of the barrier beaches to public use.

Cooperation With the States

Advisory assistance was given in 48 States on 771 occasions, an increase of 23 percent over 1961. Of special interest is the increase in the number of requests received for assistance in interpretive planning and requests from Indian tribes for planning recreation developments on their lands. In the future, such activities will also be continued by the Department's Bureau of Outdoor Recreation.



Federal and State agencies cooperated in making a storm damage survey along the Atlantic coast following the disastrous storm of March 6 and 7, 1962. Assateague Island, Md., above, was one of the areas where damage to the dunes and barriers was severe. Suggestions were advanced for making the island a public recreational area.

"State Park Statistics—1961" shows substantial increases in acquisition, development, and use of State parks. Tabulations show (1) attendance exceeding 273 million, including 23 million overnight visitors; (2) expenditure of \$61 million for operation and maintenance, \$13 million for land acquisition, and \$36 million for improvements; (3) revenue from operations of \$23 million; and (4) 7,984 year-round and 10,142 seasonal personnel. Reported also was a total of 2,792 areas embracing almost 6 million acres.

Real Property Disposal

Recommendations were furnished to General Services Administration on 28 applications submitted by the States and their political subdivisions to acquire Federal surplus real properties for public park, recreation, and historic monument purposes. The Service has carried compliance responsibility on a total of 232 properties embracing 30,395 acres. Recommendations also were furnished to the Department's Bureau of Land Management on 78 applications to acquire public-domain lands for similar purposes.

Reservoir Planning and Management

Two important new policies on acquisition of lands and provision of recreation facilities on reservoir projects—one issued by the Secretary of the Interior relating to reservoirs constructed by the Department's Bureau of Reclamation and the other issued jointly by the Secretaries of the Interior and Army relating to both Reclamation and Corps of Engineers projects. These policies provide for all planning reports to include recommendations for Federal acquisition of all lands needed in the foreseeable future for recreation purposes and the provision of basic recreation facilities required for current needs.

Also of outstanding significance is the new statement "Policies, Standards, and Procedures in the Formulation, Evaluation, and Review of Plans for Use and Development of Water and Related Land Resources," approved by the President on the recommendations of the Secretaries of the Interior, Army, Agriculture, and Health, Education, and Welfare. This provides that recreation will be given equivalent consideration as a project purpose on all Federal multi-purpose water resources projects.

During the year, 90 recreation reports were prepared for the Bureau of Reclamation and 38 for the Corps of Engineers and arrangements were concluded with State and local agencies to manage recreation developments on 7 Reclamation reservoirs. Twenty-one applications for Federal Power Commission permits and licenses were received and recommendations provided to the Office of the Project Review Coordinator.

The Service made its experienced park and recreation specialists available to provide advisory and planning assistance to States and their political subdivisions taking advantage of the Area Redevelopment Administration program which was authorized by an act of Congress approved May 1, 1961.

Design and Construction

The construction program was the most intensive of any previous year in the National Park Service history. There were 775 new construction projects programed at approximately \$63,166,500, including projects for recreational facilities in the Upper Colorado River Basin Reservoir areas, not including exhibits, interpretive devices, rehabilitation projects, and advanced planning which in themselves amounted to \$2 million.

The new projects, plus work carried over from the previous year, came to 1,667 projects in the active construction program totaling \$134,677,747. As of May 1962 these totals, through further program adjustments, had increased to 1,740 projects amounting to \$135,007,429. Of all projects, 26 percent were completed and an additional 58 percent were under construction. Only 16 percent were not under construction. To augment professional services provided by the field design and construction offices, 22 contracts for professional architectural and engineering services for approximately \$144,150 were awarded. Projects involved were estimated to cost approximately \$7 million.

Architecture

The Service awarded its biggest contract for the "Gateway Arch," a 630-foot stainless steel arch which will rise on the St. Louis waterfront at Jefferson National Expansion Memorial. It will be a dominant feature of downtown St. Louis and is scheduled for completion in 1964, the 200th anniversary of St. Louis.

The stately visitor center at Parachute Key, Everglades National Park, an example of dignified Federal architecture, was completed prior to the heavy upsurge of winter visitor use. The Rock Creek Park Nature Center in Washington, D.C., filled a long-felt need and is enjoyed by thousands of visitors in the Nation's Capital.

An unusual architectural design concept, based on the historical precedent of the octagonal blockhouse of Revolutionary and post-Revolutionary times, resulted in the pleasant visitor center at Saratoga National Military Park.

The Gettysburg Cyclorama and Visitor Center, featuring the colossal painting of the battle by Pierre Philapoteaux, also provides

a rostrum for important speakers and an auditorium and gathering ground for several thousand people, in honor of Lincoln's immortal Gettysburg Address.

The faithful restoration of Congress Hall which shows with exactitude the conditions, architecture and decor under which the First Continental Congress met adjacent to Independence Hall in Philadelphia is a worthy achievement in the historic buildings program.

Engineering

The Division of Engineering supervised 1,134 projects. A total of 485 minor roads and trails projects were programed in 122 areas providing improvement of visitor facilities and extension and enlargement of campground and picnic areas. These, plus projects providing public access to newly acquired areas, totaled \$22,756,595.

A significant accomplishment was the start of a 20-mile jeep trail at Katmai in Alaska, from Brooks River Camp through a magnificent wilderness to overlook the Valley of 10,000 Smokes. Heavy equipment and supplies were moved to King Salmon by air across the frozen Naknek River to Brooks River Camp. Twenty-three visitor facility projects were constructed on the Blue Ridge Parkway. Reconstruction of facilities damaged by the hurricane at Cape Hatteras and Everglades and reconstruction of roads and trails damaged during the 1961 earthquake at Yellowstone were major projects.

Twenty-seven projects were completed to provide commercial power and telephone service including lighting at Mammoth Cave and Carlsbad Caverns and powerlines at Blue Ridge Parkway, Fort Pulaski, Lake Mead, and Olympic. Five additional radio systems were completed, bringing the total of leased commercial systems to 36. Most notable were the Blue Ridge and Natchez Trace Parkways systems. The Natchez Trace system employs 10 frequencies and permits instant and constant contact throughout the 450 miles of the Parkway. Special audiovisual equipment designed to provide automatic slide-sound programs was installed in nine park auditoriums and three amphitheaters. Electric maps coordinated with narrated descriptions illustrate troop movements at Horseshoe Bend, Fredericksburg, and Spotsylvania.

General utilities and miscellaneous structures such as marinas, docks, and interpretive facilities were expanded. Water and sewer facilities were constructed in 28 States, the District of Columbia, Puerto Rico, and the Virgin Islands. Three hundred and fifty-nine projects such as signs, picnic and camping facilities, and campfire circles were constructed in 33 States. One hundred and three camping areas were developed in 51 areas to bring the total sites in the system to nearly 22,000.

Landscape Architecture

Greatest emphasis was placed on programs providing additional miles for continuous travel on the national parkways, improved visitor facilities, the study of future parkways, and significant major park road development across the Nation. For parkway programs, a total contract authorization for \$16 million was distributed among the Blue Ridge, Colonial, Foothills, George Washington Memorial, Natchez Trace, and Suitland Parkways. On June 30 there were 37 major contracts totaling approximately \$26,300,000 in process under the Bureau of Public Roads major roads program. These include 52 miles of final paving, 69 miles of grading and base course work, 36 bridges and grade separation structures, 9 tunnels, and other road-work. Outstanding major park road projects completed included developments in the East and Far West at a cost of \$8.5 million.

Master Plan Coordination

A Division of Master Plan Coordination provides, for the first time, central coordination and direction to the Service-wide program of master plan preparation and consists of two major branches, master plan narratives and master plan drawings.

Master plans for the Upper Colorado River Basin Reservoir areas such as Crawford, Flaming Gorge, Glen Canyon, Navajo, Paonia, and Steinaker have been prepared. Construction in some of these areas has already been undertaken or scheduled.

Lands

Recognizing the pressing National Park System land requirements for conservation, development, and opening of additional areas to the visiting public and to establish vital new parks, the Congress appropriated a total of \$7,600,000 for the purchase of lands for fiscal 1962. The 22,950,000 acres of land and water comprising the areas of the National Park System is less than 1 percent of the total area of the United States. They include non-Federal lands totaling 433,000 acres. Although less than 2 percent of the gross acreage, these in-holdings constitute a serious administrative handicap out of all proportion relative to the 22,517,000 acres of Federal lands now in the National Park System. Purchase of 14,000 acres in both newly authorized areas and in established areas, including Civil War sites, is in process.

The newly authorized areas are Bent's Old Fort National Historic Site, Colo., and Minute Man National Historical Park and Cape Cod National Seashore, both in Massachusetts. Negotiations are progressing in these three areas for the purchase of properties.

Land-purchase programs are active in 21 established areas, including five Civil War sites, with realty acquisitions varying in acreage and description from a 0.081-acre extensively improved historical parcel of city land to a 1,200-acre tract of scenic semiarid grazing land. Other scheduled purchases are homesite subdivisions in stands of beautiful trees, rights-of-way for road construction, sites for visitor centers, mining claims, structures of historical and architectural significance, blighted city property which is a fire hazard threat to nearby historical buildings, sites of Civil War events and lands to enhance vistas.

Various public agencies, private organizations, and individuals during the year have donated to the United States real property within nine areas of the system for the use of all the people of the United States. Land exchanges in six areas brought significant properties into Federal ownership.

Other Federal bureaus transferred scenic and important lands to the custody and jurisdiction of the National Park Service in six of its areas.

Water Rights

A major challenge has developed in the struggle to preserve the ecology of Everglades National Park as an asset in the growth of southern Florida. Approximately 90 percent of its fresh water resources originate at precipitation on the park and 10 percent on the adjacent Central and Southern Florida Flood Control District. That 10 percent, with its seasonal and annual variation in quantity, is essential to maintain a balanced subtropical ecology on the seasonally inundated land area; and in the brackish water of its bays and estuaries, which are a vital element in the life cycle of the Tortugas shrimp and other sports and commercial fish on which established industries have grown throughout the State. It is also needed for the increasing population and other industries of metropolitan Dade County. The problem is to determine the portion of the 10 percent which may be spared for the other municipal and industrial purposes without jeopardizing the ecology, and to cooperate in planning the central and southern Florida flood control project throughout the Greater Everglades drainage including the Kissimmee River to provide flood control, drainage, and water storage and allocation for all purposes.

Park Attendance

Fiscal year 1962 brought 82,300,000 visits to the national parks and related areas; an increase of 8.6 percent over fiscal year 1961. Early in the year, total travel moved firmly across the long-run 1947-62 normal growth curve, thus indicating a trend toward a heavier-than-normal public use of the parks throughout calendar year 1962 and probably into 1963, after which a relative and modest softening of this curve may reasonably be expected to occur.



Over 82,300,000 visits were recorded in areas of the National Park System during fiscal 1962, for an 8.6-percent increase over the previous year. Old Faithful, above, continues to be a main attraction at Yellowstone National Park.

Turning to calendar year comparison, 1961 growth in total visits over 1960 was not uniform throughout the Nation. Parks in Southeastern United States rose 12 percent; the Pacific coast and the National Capital area increased 9 percent; Northeast was up 4 percent; while travel to parks in the Rocky Mountains, the Plains, and the Southwest produced changes of less than 1 percent.

Camping in the national parks was up 4.4 percent from 1960 with a total of 5,051,000 camper days. None of the increase occurred in tent camping—all of it was in trailer camping which increased 17 percent—so as to amount to almost 30 percent of all camping in the parks. The expansion of camping facilities reduced the total propor-

tion of public camping in irregular or overcapacity conditions to 11 percent from the 14 percent recorded in 1960.

Budget and Finance

Continued improvement in the Service's capacity and capability for meeting its responsibilities was realized through 1962 fiscal year appropriation increases. In addition to increases in its regular appropriations, funds were provided the Service in the Department's Bureau of Reclamation's appropriation to initiate construction of recreation facilities in the Upper Colorado River Basin Reservoir area sites as authorized by the Colorado River Storage Project Act. The following is a comparison of the 1962 appropriations with those for 1961:

Appropriation item	1961 fiscal year	1962 fiscal year	Increase
Service appropriations:			
Management and protection-----	\$20,509,000	\$22,586,500	\$2,077,500
Maintenance and rehabilitation of physical facilities-----	15,800,000	18,269,000	2,469,000
General administrative expenses-----	1,581,000	1,581,000	-----
Construction-----	21,528,000	36,726,000	15,198,000
Construction (liquidation of contract authorization)-----	30,000,000	30,000,000	-----
Total cash appropriations-----	89,418,000	109,162,500	19,744,500
Construction (amount by which roads and trails and parkways contract authorization exceeded cash appropriation)-----	4,000,000	4,000,000	-----
Total new obligational authority Service appropriations-----	93,418,000	113,162,500	19,744,500
Appropriation transfers from other agencies-----	5,342,000	7,850,400	2,508,400
Grand total, new obligational authority-----	98,760,000	121,012,900	22,252,900

Of the total increases reflected in the foregoing, \$4,894,000 was for continuation of construction at Jefferson National Expansion Memorial, \$1 million to commence a program for construction of facilities in the New York City Shrines areas, \$2,270,500 for construction of recreation facilities in the Upper Colorado River Basin Reservoir area sites, \$2,250,000 for commencement of land acquisitions for the newly authorized Cape Cod National Seashore, \$1 million to continue the land acquisition program for Minute Man National Historical Park, and \$1,875,000 for acquisition of lands in other park areas. The remainder, \$8,963,400, was for strengthening the various Service programs.

A comprehensive review of the Service's visitor fee system was commenced during the fiscal year. With the provision of additional visitor facilities and additional uniformed personnel, there are a number of areas not presently producing any significant amounts of revenues where the charging of visitor fees is now warranted and in some instances changes should be made in the fees currently authorized. Consideration is also being given to any different types of fees

that might be charged to make the system more equitable or to insure realization of the full revenue potential within governing policy and principles. The study was still in progress at the close of the fiscal year. It will be continued and completed in the light of developments with respect to the pending land conservation fund legislation, H.R. 11173 and S. 3118.

NATIONAL CAPITAL PARKS

Legislation was passed in the Congress and signed by the President during the year that will provide for the preservation of certain lands on Piscataway Creek in Prince Georges and Charles Counties, Md., known as the Mockley Point or Moyoane Park area on the opposite side of the Potomac River from Mount Vernon. The Department is authorized to acquire the land for park purposes—approximately 2,600 acres for scenic easements and 1,186 acres by outright acquisition. Plans are being made for early acquisition of the properties, about half of which will be donated. Thus, the use of this scenic and historic area by commercial developments or, as suggested, as a site for a sewer plant, would be averted.

Visitor Center

A new visitor center to serve the ever-increasing number of visitors to the Nation's Capital—on Hains Point overlooking the Anacostia and Potomac Rivers—was opened to the public on March 16 as a pilot project. By the end of the fiscal year 48,087 schoolchildren and other visitors had been “oriented” at the center by means of exhibits, maps, photographs, movies, and slides.

Cultural Developments

The National Capital Planning Commission and the Fine Arts Commission approved a site on Daingerfield Island, George Washington Memorial Parkway, for the world's largest planetarium—proposed to be erected with funds to be raised by the Washington Planetarium and Space Center. This brings closer to reality an outstanding addition to the cultural development of the Nation's Capital.

The Committee appointed by the President to raise funds for the National Cultural Center—planned for a site on the Potomac River upstream from the Lincoln Memorial—is making strides toward a fulfillment of this long-nourished dream for a facility to meet the need of Washington residents by providing a suitable “home” for cultural programs and exhibits.

Also proposed for construction in the District of Columbia is a \$10 million aquarium. One site suggested was East Potomac Park. Legislation authorizing the aquarium has passed the House. The Interior Department has endorsed the bill.

Memorials

Attendance at the memorials has made a new record during the past year. A comparison of attendance for calendar years 1960 and 1961 at the six most prominent memorials and the White House is given below:

	1960	1961
Lincoln Memorial.....	2, 488, 174	2, 889, 982
Washington Monument.....	1, 392, 891	1, 592, 279
Jefferson Memorial.....	926, 920	811, 547
Custis-Lee Mansion.....	348, 166	321, 919
Lincoln Museum.....	221, 877	250, 674
House Where Lincoln Died.....	135, 562	154, 578
White House.....	809, 639	1, 321, 552
	<hr/> 6, 323, 229	<hr/> 7, 342, 531

Glover-Archbold Park

Expressway encroachment upon the natural beauty of this park area, donated to the National Park Service by the Glover and Archbold families, has been vigorously opposed by the Department of the Interior and the National Park Service. Legislation to prevent this development has been introduced in Congress and passed by the Senate.

Bureau of Outdoor Recreation

Edward C. Crafts, *Director*

The Bureau of Outdoor Recreation is the newest unit of the Department of the Interior. It had its beginning with the Outdoor Recreation Resources Review Commission, a Commission of 15 distinguished citizens, including 8 Members of Congress, created by an act of Congress on June 28, 1958. The Commission was chaired by Laurence S. Rockefeller and had the assistance of an advisory council consisting of 25 individuals from various walks of life and top-level representatives from 15 Federal agencies. State contact officers were appointed by the Governors of every State.

ORRRC Reports

The Commission reported to the President and Congress on January 31, 1962, submitting some 50-odd recommendations falling into 5 general categories. These categories called for:

1. A national outdoor recreation policy.
2. Guidelines for the management of outdoor recreation resources.
3. Expansion, modification, and intensification of present programs to meet increasing needs.
4. Establishment of a Bureau of Outdoor Recreation in the Federal Government.
5. A Federal grants-in-aid program to the States.

Presidential Conservation Message

On March 1, 1962, 1 month after the Commission submitted its report, President Kennedy sent to the Congress a message on conservation, announcing that a Bureau of Outdoor Recreation would be created within the Department of the Interior. The President said:

"This Bureau will carry out planning functions already assigned to the Department of the Interior and will administer the pro-

gram of Federal assistance for State agencies I am proposing below. This new Bureau will serve as a focal point in the Federal Government for the many activities related to outdoor recreation and will work and consult with the Departments of Agriculture, Army, and Health, Education, and Welfare, the Housing and Home Finance Agency, and with other governmental agencies in implementing Federal outdoor recreation policies.”

In the same message he stated:

“I shall appoint an Outdoor Recreation Advisory Council made up of the heads of departments and agencies principally concerned with recreation—to provide a proper forum for considering national recreation policy and to facilitate coordinated efforts among the various agencies.”

Secretary Establishes Bureau

Both of these things were done. On April 2, 1962, Secretary Udall, by secretarial order, established a Bureau of Outdoor Recreation. His order stated that the Bureau is responsible for—

(a) Coordination of related Federal outdoor recreation programs.

(b) Stimulation of and provision for recreation assistance to the States.

(c) Sponsorship and conduct of recreation research.

(d) Encouragement of interstate and regional cooperation in recreation projects.

(e) Conduct of recreation resource surveys.

(f) Formulation of a nationwide recreation plan on the basis of State, regional, and Federal plans.

Recreation Advisory Council

On April 27, 1962, President Kennedy issued Executive Order 11017 establishing a Cabinet-level Recreation Advisory Council with a rotating chairmanship.

In the Executive order, the Secretary of the Interior was made responsible, in consultation with other members of the Council “for developing methods and procedures for improved interagency coordination in the development and carrying out of national outdoor recreation policies and programs.”

The order also stated that “The Council shall provide broad policy advice to the heads of Federal agencies on all important matters affecting outdoor recreation resources and shall facilitate coordinated efforts among the various Federal agencies.”

These are the basic guidelines for the Bureau of Outdoor Recreation. The rapidity with which action followed recommendations was

extraordinary. The Commission committed itself on January 31. The President committed himself on March 1. Secretary Udall activated one of the Presidential commitments on April 2 and the second was activated on April 27, 1962.

Declarations of Intent

In June, the Bureau of Outdoor Recreation listed a number of declarations of intent which represent the policies it will pursue:

1. Outdoor recreation needs to be vigorously advocated across the land and in chambers where policy is made. The Bureau hopes to be one of the advocates and to balance enthusiasm with realism.

2. There needs to be national and nonpolitical leadership in recreation. The Bureau of Outdoor Recreation as a career service should provide that leadership. It should be intellectual leadership. There needs to be effective articulation that reaches the public heart and mind.

3. There needs to be public understanding that recreation is not only a renewing experience but also a serious business. It is serious national business both because of its economic impact and its beneficial effect on the physical, cultural, social, and moral well-being of the American people. It is a partial solution to the social problems created by urbanization and leisure time. It is a solution, at least in part, to the fact that man is not wholly suited physiologically to meet the technological demands placed upon him.

4. The recreation business is one of the great hopes for economic improvement of certain rural portions of this country that are otherwise depressed. Further, the manufacture and marketing of recreation equipment and provision of recreation facilities have a major impact on our economy. The investment in men, money, and resources involved in the manufacture, use, and operation of sporting arms, fishing tackle, camping equipment, pleasure boats, winter sports equipment, pleasure trailers, recreation roads, resort hotels, motels, lodges, and dude ranches, and the recreation press is tremendous. All of this is recognized in the new Bureau.

5. There is need to professionalize recreation education in colleges and universities. Persons currently engaged in providing recreation for others comprise a multitude of disciplines—geographers, foresters, landscape architects, zoologists, physical education majors, engineers, and so on. Recreation conservation needs to be recognized professionally as other fields of conservation are today. There is the other side of the coin, too; the education of those who wish to partake intelligently and effectively of recreation opportunities. More is being done in this field than in the education of the professional technician in outdoor recreation.

6. The Bureau of Outdoor Recreation is and should continue to be small in terms of personnel and money. Though it be small in men and dollars, the Bureau hopes to loom large in policy and in contribution to the welfare of the American people.

7. There will be no empire building in the Bureau. The primary emphasis of the Bureau should be on assistance to the States, to local instrumentalities of government, and to private enterprise. The Bureau hopes to facilitate, to aid, and to be a catalytic agent.

8. The Bureau will not be a land-managing agency. Its duties will be policy, planning, long-range programs, and coordination. The emphasis should be on quality—not quantity; improvement of standards and facilities, attraction of better personnel, and broadening of vision.

9. Most of the people are where the land is not. Recreation opportunities need to be made more accessible to people; so much of the emphasis of the Bureau will necessarily be in the East and on the west coast where population concentrations occur.

10. In the Federal area, the Bureau function is coordination, programing, and promotion of Federal acquisition of certain properties needed for the furtherance of the recreation aims of the national forest and park systems, certain wildlife refuges and game ranges, and the Federal reservoirs.

11. The objective of correlation may be achieved through legislative review, budgetary review, conference, consultation, and the respect and stature which the Bureau may gain over a period of time as well as the force of public opinion which may develop behind it.

12. The Bureau of Outdoor Recreation is not another National Park Service or another Forest Service. Its orientation, scope, approach, and objectives are quite different from any existing agency of government, Federal or State. It is in a very real sense of new experiment in government.

13. The emphasis of the Bureau will be oriented first toward the needs of the people and then on effective utilization of a specific land and/or water resource.

14. The Bureau will push vigorously for the legislation, funds, and policies it believes in the public interest.

15. Outdoor recreation plans should lead to action. The Bureau will not knowingly engage in planning which finds its use only with students and in reference libraries. Planning and programing are primarily significant in direct relation to the results stemming from them.

Bureau Organization

The Bureau has been organized with a Director, Associate Director, two Assistant Directors, and six Divisions.

The Divisions are (1) Cooperative Services, (2) Planning and Surveys, (3) Federal Programs, (4) Education and Interpretation, (5) Research, and (6) Administrative Services.

Presidential Statement

Two points which the President made in his talk at the White House Conference on Conservation in May, 1962, are of particular interest. In emphasizing the need to apply science to conservation, the President said that the successful application of science to conservation may result in a great deal more lasting benefit to a particular country than being first in space. He also said, "I don't think there is anything that could occupy our attention with more distinction than trying to preserve for those who come after us this beautiful country which we have inherited."

Office of Territories

Richard F. Taitano, *Director*



The new programs and policies of the Secretary of the Interior which were put into effect in all of our offshore areas have resulted in substantial political, economic, and social advancement during fiscal 1962.

The high degree of responsibility shown by the people of the Virgin Islands in administering their government prompted President Kennedy to send a message to the Congress urging the enactment of home rule for the islands, including the right to elect their own Governor. Legislation to provide for the popular election of the Governor of Guam was also introduced into the Congress and is receiving the Department's wholehearted support.

In the Trust Territory of the Pacific Islands, a review of needs resulted in enactment of legislation more than doubling the appropriation ceiling for the area. It is the Administration's aim to place education in the trust territory on a basis comparable to that in the United States, as well as to improve political and economic development. Political progress was made in the trust territory with the transformation of the Advisory Council into the Council of Micronesia, and the election by secret ballot for the first time of delegates to the annual conference of the Council.

In American Samoa, new awareness has brought an increased action to meet the needs of that South Pacific territory, and a major effort was begun to meet these urgent requirements. Substantial progress has been made. In all territories, new programs were put into effect reflecting a greater use of the human resources of the territory and the provision of a better way of life for the people.

Guam

The relaxation of entry requirements imposed by a 1941 Presidential order highlighted the fiscal year in Guam and paved the way for a new attitude of confidence in the business and governmental communities of this Western Pacific territory. U.S. citizens may now enter the island without undergoing naval security clearance. The removal of this requirement enabled Guam, for the first time, to begin developing a tourist industry which can appeal to the thousands of visitors who travel to the Far East each year. The Guam government negotiated the sale of a land parcel overlooking historic Adelup Point for construction of a 100-room resort hotel, to be completed in 1963.

With a total operating budget of \$13,471,597, Guam spent \$1,293,290 on badly needed capital improvements.

The 750-student Barrigada Junior High School, costing \$603,190, and the 720-student Barrigada Elementary School, costing \$466,530, were pushed toward completion for the September 1962 school term.

A contract was approved and the foundation laid for a new \$245,865 classroom building at the College of Guam, and architects began work on plans for a new \$450,000 courthouse in Agana.

Buildings to house the commissioners' office, fire and police units and health centers were completed in five villages and contracts let for similar structures in three other villages.

Plans were completed and funds appropriated for two village classroom additions, an improved telephone exchange for Merizo, and a major water reservoir for Talofoto.

The island's highways underwent a concerted rehabilitation program at a cost of \$406,890, three new beach parks were completed, and heavy growths of unsightly and unhealthful jungles were cleared from vacant lots in Agana, the capital city.

Space formerly used for tuberculosis patients at the Guam Memorial Hospital was converted at minimum cost into a modern psychiatric ward, eliminating the need to send mental patients off-island for treatment.

The first school for practical nurses was started and negotiations completed with the Commission on Accreditation of Hospitals for a survey which should bring full accreditation and improve the off-island recruitment of professional people.

Public health services were expanded in the villages and an independent laboratory was established to greatly improve continuing research in diabetes, gout, high blood pressure, and obesity, ailments which are prevalent among Guamanians.



A new, sturdy fence has been completed around a 125-acre pasture, reclaimed from the military, which is being developed as a demonstration point to stimulate ranching on Guam. Government herds will be grazed in the pasture.

An economist, on loan from the Department of Interior, completed a survey and plan of action designed to qualify Guam under the Area Redevelopment Act.

The Guamanian Departments of Labor and Personnel and Education took initial steps through the U.S. Department of Labor for participation in the Manpower Development and Training Act. This should lead to elimination of unemployment on the one hand and a shortage of properly trained workers for local civilian and military trade jobs on the other.



A floor in Guam Memorial Hospital which formerly was used for tuberculars has been converted into a modern psychiatric ward, eliminating the need to send serious mental cases off island for treatment.

Safeguards governing off-island recruiting were strengthened and some longstanding double standards governing recruitment and promotion of Guamanians and off-islanders in the education department were removed.

In the public schools, enrollment passed the 14,000 mark. Teachers participated, on a voluntary basis, in special courses in the English language for over 600 pre-school children from Chamorro-speaking families.

Steps were taken toward the accreditation of the College of Guam as a 4-year school by the Western College Association.

In line with President Kennedy's physical fitness program, Guam's schools initiated a full-fledged athletic training plan, which will include all grades and will speed the development of interscholastic competition.

The Sixth Guam Legislature completed active sessions, with the passage of a bill revising the island's tax structure among its major accomplishments. The legislature also adopted a resolution favoring popular election of the Governor of Guam.



The foundation is laid for a new \$245,865 classroom building at the College of Guam. Another classroom building, library, and cafeteria-recreation hall are in the background.

Trust Territory of the Pacific Islands

In the fiscal year, the President transferred jurisdiction over the Saipan District in the Northern Marianas to the Secretary of the Interior from the Secretary of the Navy, effective July 1, 1962. The entire trust territory thus will be unified in administration under the High Commissioner. Effective July 1, the former Saipan and Rota Districts will be combined into the Mariana Islands District. At the same time, the administrative center of the trust territory will be transferred from Guam to Saipan.

Emphasis in administration was given to projects to foster educational and political advancement and for increasing the Micronesian income. An economic survey was undertaken by an economist from the Department of the Interior in Washington. Efforts were made to promote new outlets for trust territory products and to provide guidance in production to meet market acceptance, capitalizing upon fish from the sea, and food, wood, and fibers from the land.



Display of Micronesian handicraft articles at Trust Territory of the Pacific Islands headquarters.

Steps were taken to open the territory to commercial fisheries development. A school of fisheries was established, and a group of the trainees, after indoctrination, was sent to Hawaii for experience in large-scale tuna fishing.

A farm institute to train Micronesians in agricultural practices was organized in Ponape District, facilities constructed and opening date set for July 1, 1962. Farmers' markets at district centers were sustained, and increased sales recorded. To further implement agricultural development, administrative directives were given to permit a step-up in the homesteading program.

Rehabilitation of coconut groves continued with a quarter million new plantings; a soapmaking project was initiated, using coconut oil as a basic ingredient. Cacao cultivation also was extended, with 600,000 cacao trees planted during the year. Plantings of spices and other potential cash crops were increased. Marketing of handicraft articles was activated at headquarters. New branch banks were opened in two districts, and the organization of local cooperatives and credit unions was given administrative support. Two small local broadcasting stations were established, and provision was made for



Micronesian medical men, in advanced training at Naval Hospital, Guam, are attending a tumor clinic with naval medical officers.

operation of such stations in all districts. Radio broadcasting is considered one of the most important communication tools for development of the islands.

Since transportation requirements of the area—which encompasses 97 inhabited islands and some 3 million square miles of water—are great, major consideration was given to means of improving facilities and schedules. One new airfield was started; rehabilitation of an old Japanese landing field was nearing completion, and a third was being planned. Simultaneously, a DC-4 craft was purchased to supplement the air service provided by two small amphibians. To augment district field-trip operations, a new 500-ton ship was acquired.

In-service training of Micronesians from district staffs was carried out in various departments at headquarters, on rotation schedules. Groups of island medical and dental officers, and nurses, learned advanced techniques in special courses arranged at naval facilities in Guam. More than 100 Micronesians, some on Government scholarships, others privately supported, were enrolled at colleges in Guam, Fiji, the Philippines, and the United States, in preparation for careers in government, business, teaching, medicine, law, agriculture, fisheries, and the trades. Secondary education was provided at the Pacific Islands Central School in Ponape, and by private sponsorship at high schools in Guam.



A newly acquired DC-4 plane is scheduled to begin trust territory inter-district service, augmenting amphibian plane service already in operation. The new craft will carry 40 passengers plus cargo.

New emphasis was given to the teaching of English throughout the school system. A year was added to the curriculum of the intermediate schools in each district, beginning with the 1962 fall term. A comprehensive building program to provide adequate elementary schools was planned. It is intended that the trust territory will become a convincing demonstration to the world of the sincere interest of the United States in the welfare of all peoples under its flag.

Alaska Public Works

In 1949, Congress authorized a \$70 million program of public works in Alaska to foster economic and social development through provision of facilities for community life. This 5-year act was later extended to June 30, 1959. Under this program the Federal Government, upon application by a public body in Alaska, has financed the entire cost of construction of approved projects and, upon their completion, transferred them to the public bodies for whom they were built at

prices that will return to the Treasury of the United States not less than 50 percent of the total cost.

The program has provided basic community facilities and other essential public works. These are a major contribution to Alaska and have materially assisted its communities in meeting the demands of the very rapid population growth of the past ten years.

The total 172 projects were physically completed as of June 30, 1962. These projects with a total value of \$69,297,160 have provided 61 school units, 13 hospitals and health centers, 8 municipal buildings, 50 sewer and water projects, 27 other projects including streets, utilities and small-boat harbors, and 22 units for emergency relief. This completes the Alaska public works program.

American Samoa

During the early part of fiscal 1962, every phase of Government was devoted to the planning of a complete rehabilitation program for American Samoa. The new Governor with the strong support of the Department spent the early months of the year outlining a 3-year rehabilitation program that would strengthen and reorganize every phase of public service in American Samoa. While the program goals were to provide Samoa with good public services in all fields and to encourage industry and commerce so as to provide an economic base, the first year's program was concentrated on completing those public projects which were needed for the Fifth South Pacific Conference, which was held in Pago Pago in July 1962.

The first phase of the program was accepted by the Congress and a total of \$9.5 million of Federal funds and \$1 million in local funds was appropriated and made available by October.

Construction

At the request of the Governor, a skilled survey team of topflight naval engineers reviewed the existing and proposed construction projects and made general recommendations. An agreement was completed with the 14th Naval District in Pearl Harbor whereby skilled engineers and technicians were loaned to the government of American Samoa on a reimbursable basis to assist on the projects authorized in the rehabilitation program. These technicians not only supervised the various construction projects, but also trained many Samoans to do their work. The technicians were returned to Honolulu upon the completion of the training.

Later in the year, two detachments of the 14th Naval District Reserve Construction Battalion volunteered a month's reserve training



Completion of a new international jet airstrip on American Samoa will open the scenic wonders of this tropical paradise to world travelers.

duty in the territory to provide further assistance in the construction program.

By March 1962, virtually every able-bodied man in Samoa was working 10 hours a day, 6 days a week, to insure completion of the most-needed projects by July 1. By this date an imposing list of projects was completed and were ready for the Conference. They included a 9,000-foot jet runway, which will provide facilities for through jet service from Hawaii and west-coast points to Australia and eventually New Zealand; a striking Polynesian style civic auditorium that seats 800 people; a new powerplant with two 1,000-kilowatt diesel-electric generating units and with additional space to be expanded to 6,000 kilowatts in the following fiscal year; 27 new housing units for government employees; 3 new high school buildings; 8.5 miles of new paved highway from the airport to downtown area, with a contract let for an additional 12 miles to be completed by October; a complete renovation of many public buildings and a government cleanup campaign which included the tearing down of dozens of old, dilapidated government buildings throughout the island.

A general cleanup and paintup campaign was sponsored by the government and through the sale of paints at cost over 90 percent of the buildings on the island of Tutuila were painted by July 1.

Education

An agreement was completed with the University of California at Berkeley to assist in the recruitment of outstanding teachers and 40 new teachers were hired to bolster the school system. With the three new high school buildings and the new teaching staff, for the first time American Samoa was prepared to enroll 100 percent of her graduates from the intermediate schools. Heretofore only one-third had been enrolled.

Among the many steps taken to bolster the grossly inadequate elementary school system was the Governor's proposal for an educational television system which, through the use of a dozen outstanding teachers in the studio, could bring the best in teaching to some 300 classrooms that are now being staffed by poorly trained local teachers.



Samoa's new civic center—to be used by students, the general public, and the legislature—is called "The Turtle" by Samoans. In the background are new school and housing facilities.

It would also be the medium for adult education, ranging from such subjects as public health to classes in self-government. With the enthusiastic support of the Secretary, the Congress appropriated funds for a survey of the feasibility of such a program. The National Association of Educational Broadcasters made a survey of the possibilities and made a strong report recommending the system. By the year's end the Congress had adopted the program and advance planning was underway.

Other steps taken to bolster the basic system included a dropping of the entrance age for schools from 7 to 6 years. Salaries for stateside-qualified teachers were increased by one-fourth and a comprehensive new construction program to replace all inadequate school buildings was presented and approved by Congress. An agreement was reached with the University of Hawaii to train 20 Samoans in agriculture and home economics under the Area Redevelopment Administration Act.

Health

A team of doctors from Yale University and the University of California at San Francisco was brought to Samoa to survey overall health needs and an additional team from the U.S. Public Health Service to initiate the planning for a new hospital. An agreement was entered into with the Hawaii Medical association whereby they agreed to send experts to American Samoa for a month of free service in specialized fields. Four surgeons under this program had given outstanding service by the end of the year and many specialty cases were located and corrected.

Arrangements were made with the State of Hawaii to care for mentally ill persons from American Samoa and also to provide facilities for the hospitalization and medical treatment of unusual diseases which could not be treated in Samoa. An agreement was reached with the University of California at Los Angeles for a filariasis and internal parasite-control program and three doctors from that university were in service in American Samoa before the year's end.

Agriculture

Several thousands of various varieties of citrus and nut trees were planted in American Samoa during the year. A widespread poultry program was instituted and steps were taken to improve existing agriculture crops.

A marketing specialist from Washington, D.C., made a survey of marketing facilities with a view to strengthening a very inadequate system.

Legislature

The legislature was called into special session in November and, during this and the regular session in March, 29 bills were passed that virtually rewrote the Code of American Samoa, which was out of date.

The groundwork was laid for replacing law by executive regulations with legislative law.



Visitors inspect the Samoan fish cannery. Efforts to attract industry to the island have resulted in plans for construction of an additional fish processing plant which will provide new employment for 300 Samoans.

Economic Development

A contract was signed for the establishment of a coconut processing plant in the Pago Pago area which will process all of American Samoa's fresh coconuts and will spur coconut production throughout the territory. The bulk of the coconuts for the plant, however, will come from Tonga and Western Samoa and will increase trade between these areas and American Samoa, thereby creating many new jobs. While the basic process of obtaining fresh coconut oil will create jobs for approximately 100 American Samoans, several specialty products, such as coconut flour, cocomats, charcoal briquets from coconut husks, and various derivatives from coconut milk, are planned, which will add additional jobs.

Negotiations were virtually completed for a second fish cannery and plans were about complete for the formation of an all-Samoan development corporation to build a hotel and other facilities to provide the basis for a tourist industry. At the end of the year \$150,000 had been pledged from hundreds of workers and other Samoans for such a development. While three other corporations were negotiating for hotel sites, these were being held in abeyance pending the completion of the Samoan corporation's plans.

An additional spur to Samoa's tourist potential was the inauguration in March of 1962 of the South Pacific Airline's service between Honolulu, Tahiti, and Samoa.

Virgin Islands

Housing, the No. 1 problem of the islands, was revitalized by the appointment of a housing coordinator; establishment of a local office of the Federal Housing and Home Finance Agency; speeding up of emergency housing construction in St. Thomas and renovation of public villages in St. Croix; commencement of a resettlement project in one of the worst slum areas; and at year's end by the creation of a new department of housing and community renewal.

The fiscal year marked the emergence of the College of the Virgin Islands. Firm plans have been made to open the college as a 2-year institution in July 1963.

Positive steps were taken within the department of education toward improving the quality of instruction at all levels of education and toward achieving accreditation for the islands' high schools. Rehabilitation of outmoded physical plants and construction of new schools were started to solve the problem of classroom shortage and inadequate physical facilities.



Governor Ralph M. Paiewonsky, flanked by officials of the Virgin Islands government including the president of the legislature, Honorable Walter I. M. Hodge, dedicates the deepwater pier at Frederiksted on the island of St. Croix. This pier costs \$1,200,000, is 1,651 feet long, and can accommodate ships up to 40 feet draft—the only deepwater dock on the island of St. Croix.

Tourism and Trade

Widely expanded activities were conducted to promote tourism and trade. Congress granted the Virgin Islands a special customs exemption of \$200 for returning tourists. As a direct result, customs dues increased from \$502,000 in fiscal year 1961 to \$890,000 in fiscal year 1962. Expenditures by tourists leaped to approximately \$35 million from \$25,800,000 in the preceding year. Cruise-ship calls exceeded all previous records.

Eleven new industries located in the Virgin Islands. The largest single industry ever to come to the islands will be an alumina processing plant for which facilities have been made available in St. Croix. Excise taxes on liquors shipped to the United States were at an all time high of \$7,700,000. The National Park Service expanded and improved its facilities on the island of St. John and established the

Buck Island Undersea Park, expected to become a prime visitor attraction, on St. Croix.

Fiscal Improvements

A management survey and design for a new centralized accounting system were prepared to commence operations in July 1962. The income tax administration program was surveyed by the U.S. Department of the Treasury and reorganization to improve tax collection services is in process. Total revenues of the islands jumped to \$11,134,000—an increase of 25.5 percent—the highest on record in the history of the territory.

A professionally directed real property reassessment program resulted in an increase of 44 percent in real property tax collections from \$348,000 in 1961 to \$503,000 in 1962. These taxes should increase well over 100 percent within 4 years.



A three-bedroom, modern concrete blockhouse which will be the model for a community resettlement project in St. Thomas, initiated and financed by the government of the Virgin Islands. A building and a 3,000-square-foot lot will be sold to prospective homeowners for not more than \$10,000.

Public Works

In public works, a contract was awarded for hauling garbage to the sea in St. Thomas. The money value of construction completed and initiated was \$6,945,000 on 40 projects, principal of which were 6 schools, airport extension on St. Thomas to handle turboprop planes, construction of a deepwater pier at Frederiksted, and construction of a jet airstrip on St. Croix. Jetplane service from the mainland to the Virgin Islands commenced in June 1962. The program of exploration for fresh water on St. Croix was successful.

Medical services were strengthened by the addition of a modern annex to the hospital at St. Croix to meet the need of the outpatient clinics and the addition of an up-to-date formula room in the hospital in St. Thomas.

An apprenticeship and training program was started. The home for the aged in St. Croix was renovated and with improved staff is resulting in 100 percent improved care. An inspection of prisons was made by the Director of the U.S. Bureau of Prisons, who recommended that a new and modern prison be built.

Legislation

Cooperation between the legislative and executive branches of the government was outstanding.

Important legislative enactments included a new civil rights law, an Unemployment Compensation Act, a new Industrial Incentive Act, a zoning and subdivision law, a Motorboat Act, a Housing Act, and liberal appropriations to finance the various public improvements mentioned in preceding sections of this report.

Government Comptroller

A cashier receipts and disbursements section was inaugurated during the year which will assist materially in auditing expenditures of the Government of the Virgin Islands. The office assisted in the preparation of the Property Manual of the Government of the Virgin Islands; participated in revising the industrial incentive program, and was instrumental in establishing an entirely new system accumulation and reporting of leave in the local government.

The fiscal year was most productive in that 20 audits were completed thereby bringing that phase of operation on a current basis. The disclosure made by the office during the audit of the lottery division enabled the local government to take positive action by way of legislation.



To relieve the serious classroom shortage, this elementary school in St. Thomas was dedicated by Secretary of the Interior, Stewart L. Udall, on March 16, 1962. Built at a cost of \$174,000, it contains 8 classrooms, 1 cafeteria-auditorium and can accommodate approximately 250 students.

Virgin Islands Corporation

The most significant contribution made by the Corporation during the year was placing in operation the new saline water distillation plant on St. Thomas. The production of potable water has exceeded the rated capacity of the plant by more than 25,000 gallons per day. This conversion of sea water to potable water will alleviate greatly the perennial shortage of water on the island of St. Thomas and reduce the quantity of water barged from Puerto Rico at high cost.

The 1962 sugarcane crop was better than average, but considerably less than the 1961 crop, which was the best in the history of the Virgin Islands. A total of 114,871 tons of sugarcane were ground and 10,757 tons of sugar, raw value, manufactured. The average production of sugarcane per acre was 31.12 tons for the Corporation and 21.89 tons for the growers. The grinding season started on February 21, 1962, and ran for 98 days. All of the sugar produced was shipped in bulk in late June. The acquisition of conveyor equip-

ment by VICORP for loading the ship at the new dock in Frederiksted resulted in decreased loading expenses, thus giving higher income to both the Corporation and the sugarcane growers.

Power

The demand for power continued to grow in St. Thomas, and the increase in peakload over the previous year was 21.6 percent. A steam turbine generator was installed in connection with the salt water distillation plant and increased available output by 3,000 kilowatts. The extension of the distribution system on St. John continued and power will soon be available throughout all areas of the island.

The increase in peakload in St. Croix over the previous year was 38.4 percent, the highest ever recorded. The economy of St. Croix has expanded rapidly as a result of jet aircraft service and a new deep-water pier at Frederiksted.

Conservation

A total of 20 earth dams were constructed under the soil and water conservation program during the year in cooperation with the U.S. Soil Conservation Service and the Virgin Islands Soil Conservation District Board. The 4 dams constructed on St. Thomas had an estimated capacity of over 1 million gallons and the 16 on St. Croix totaled nearly 15 million gallons. The government of the Virgin Islands undertook an extensive well-drilling program in St. Croix during the year and brought in a number of wells which will greatly alleviate the water shortage. There is no doubt that the success of the well-drilling project can be attributed in a large part to the dams which have been constructed by VICORP over the past 8 years. This program has been taken over by the government of the Virgin Islands as of July 1, 1962.

The U.S. Forest Service continued to cooperate in our forestry program, through providing personnel and technical assistance. The activities continued to be primarily reforestation, improvement of existing forest areas, and making forest products available to the public. The sawmill was operated intermittently and mahogany and other local hardwoods were milled for use by local furniture manufacturing industries.

The food production and livestock programs were continued in cooperation with the Federal Agricultural Station. The commercial plantings of mangos, avocados, and macadamia nuts continue to do well, but it will be several years before they will bear fruit.

The Corporation continued the management of the Navy properties on St. Thomas for the Department of the Interior. Income from the properties increased to \$365,381, which is more than three times the income being received when the properties were taken over by VICORP on July 1, 1954.

The Alaska Railroad

John E. Manley, *General Manager*

Gross revenues of the Railroad amounted to \$14,455,224.81. Expenses, including depreciation charges of \$2,136,279.78, were \$14,202,124.40. The net income of \$253,100.41 represents an increase of \$453,238.89 over the prior year accounted for as follows:

Increase in revenues.....	\$146, 929. 70
Decrease in expenses.....	306, 309. 19
	<hr/>
	453, 238. 89

The Railroad carried 1,447,966 revenue tons of freight, an increase of 10.25 percent compared with the prior year. The number of revenue passengers dropped to 67,417 from 82,742 carried during the prior year, or a decrease of about 22.6 percent. The decline in the number of passengers was largely compensated, however, by increases in passenger-miles, revenue per passenger, and revenue passengers per train. Passenger revenues were but \$25,273.49 below those of fiscal year 1961.

Revenues from transportation of mail dropped \$104,000 compared with the prior year due to the establishment of mail-truck service to Alaska from Seattle.

The advantages of containerized freight were increasingly apparent during the year. To meet the growing demand for this type of service, 50 additional cargo containers and 25 shipping platforms were acquired. The use of these cargo containers and shipping platforms has, to a large degree, offset the constantly increasing cost of long-shore labor in terminal operations. Costs of handling the containers over the Seward Dock will be materially reduced when four large straddle trucks are placed in service.

The use of these straddle trucks will transfer the operation of loading containers to flatcars away from shipside to the backup area of the dock. The elimination of this congestion at shipside will reduce the lay time of vessels and economies will reflect to them as well as The Alaska Railroad. Delivery of these modern devices is expected in mid-September.



The arrival of Canadian National Railways barges started in May 1962, bringing new service and substantial economies

With the arrival of the first Canadian National Railways rail barge at Whittier on May 18, 1962, a new type of service became a reality. The movement of freight in cars by barge from Prince Rupert to Whittier for subsequent handling by The Alaska Railroad is expected to result in substantial economies in heavy shipments originating east of the Missouri River. The barge slip at Whittier was constructed by the Railroad at a cost of about \$250,000.

Better service and substantial economies will result for The Alaska Railroad by the new barge service of the Canadian National Railways whose first barge arrived at Whittier, Alaska, in May 1962.

Office of the Assistant Secretary Water and Power Development

Kenneth Holum, *Assistant Secretary*

The Assistant Secretary for Water and Power Development acts for the Secretary in implementing this area of the Department's program. He exercises secretarial supervision and direction over the Bureau of Reclamation, Bonneville Power Administration, Southeastern Power Administration, Southwestern Power Administration and the Office of Saline Water.

Largest and oldest of these agencies is the Bureau of Reclamation which constructs water-use projects primarily for the reclamation of arid and semiarid lands in the West and markets electric power from projects built by itself, the International Boundary and Water Commission, and the Corps of Engineers in the 17 Western States, exclusive of the Bonneville Power Administration's area.

Bonneville Power Administration, Southeastern Power Administration, and Southwestern Power Administration are power marketing agencies. Along with the Bureau of Reclamation they market all electric power generated from all federally built water-resource development projects and facilities.

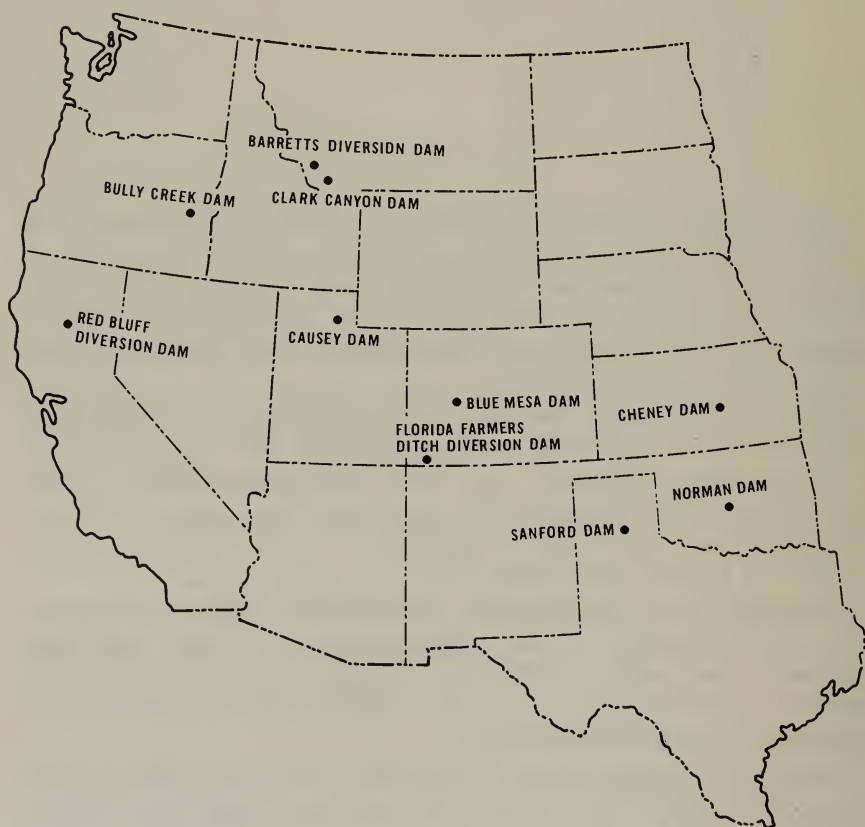
Bonneville's market area is a four-State area of the Pacific Northwest. Southeastern sells power in Southeast States and Southwestern Power Administration in the Central Southwest States.

The Bureau of Reclamation, Bonneville Power Administration, and the Southwestern Power Administration have constructed and operate extensive high-voltage transmission systems. Activity is

continuing on studies for interconnections of Federal systems, with particular progress being made on a proposed Pacific Northwest-Pacific Southwest high-capacity intertie and an interconnection between the Southwestern Power Administration and the Bureau of Reclamation. Studies are in progress on an experimental segment of direct current line to provide design data which will be utilized for construction of a high-voltage, direct-current transmission interconnection.

CONSTRUCTION STARTS

FISCAL YEAR 1962



Power is marketed under the following sets of principles established by Congress and policy:

1. Preference in power sales shall be given public agencies and cooperatives.

2. Domestic and rural consumers shall have priority over other consumers in the disposal of power.

3. Power shall be sold at the lowest possible rates consistent with sound business principles.

4. Power disposal shall be such as to encourage widespread use to prevent monopolization.

Pertinent data covering hydroelectric power marketing by the Department of Interior agencies in fiscal year 1962 are summarized in the following table:

Power production and marketing data, fiscal year ended June 30, 1962

Marketing agency	Installed capacity, as of June 30, 1962 (kilowatts)	Net energy generated (million kilowatt-hours)	Energy marketed (million kilowatt-hours)	Gross revenue (thousands of dollars)	Percent of power marketed to preference customers
Bureau of Reclamation.....	¹ 6,396,085	26,734	² 14,528	³ 56,660	⁴ 86.3
Bonneville Power Administration.....	⁵ 4,237,000	⁶ 19,192	29,157	74,483	⁷ 43.4
Southwestern Power Administration.....	⁸ 791,000	2,239	2,366	16,075	71.5
Southeastern Power Administration.....	⁹ 1,399,400	4,470	4,424	23,212	⁹ 33.5
Total.....	12,823,485	52,635	50,475	170,430	

¹ 5,294,550 kilowatts in Bureau of Reclamation plants; 1,070,035 kilowatts in Corps of Engineers plants; and 31,500 kilowatts in International Boundary and Water Commission plants.

² Excludes 12,188 million kilowatt-hours delivered at Grand Coulee, Hungry Horse, Chandler, and Roza powerplants by Bureau of Reclamation to Bonneville Power Administration.

³ Excludes \$16,978,000 revenue received by Bureau of Reclamation from Bonneville Power Administration.

⁴ Excludes energy delivered to Bonneville Power Administration.

⁵ Excludes capacity from Bureau of Reclamation powerplants from which Bonneville Power Administration markets power. This capacity totals 2,252,250 kilowatts at Grand Coulee, Hungry Horse, Chandler, and Roza powerplants.

⁶ Does not include generation at Bureau of Reclamation projects.

⁷ Excludes deliveries to Federal agencies.

⁸ Capacity in Corps of Engineers projects.

⁹ In addition, 53.2 percent of the total energy was marketed to Tennessee Valley Authority.

The Department's program to develop low-cost methods of converting sea and brackish water to fresh, conducted by the Office of Saline Water, moved ahead during the year at an accelerated pace. Basic and applied research activities were expanded; a 1-million-gallon-per-day sea-water conversion demonstration plant was completed and placed in operation at San Diego, Calif.; a 250,000-gallon-per-day brackish water plant began supplying desalted water to Webster, S. Dak.; and ground was broken for a 1-million-gallon-per-day plant at Roswell, N. Mex.

Certain defense functions dealing with electric power have been delegated to the Department. These responsibilities are discharged by the Assistant Secretary through direction of the Defense Electric Power Administration. Under this program, a field organization stands ready to handle specific postattack power problems. It is made up of 16 power areas within the continental United States and 3 others—Alaska, Hawaii, and Puerto Rico-Virgin Islands, each headed by a director with a deputy and an alternate. Power liaison personnel have been appointed to each of the OEP-OCD regional offices, desig-

nated for each State and most of the local civil defense offices throughout the Nation.

The Assistant Secretary conducted numerous conferences in Washington and in the field on power marketing problems and irrigation matters with water and power consumer groups, congressional delegations, and representatives of industry and local interests. He testified before congressional committees and appeared before interagency groups.

During the year, the Office of Assistant Secretary reviewed 136 reports of the Corps of Engineers, Department of the Army, primarily for flood control and navigation improvements; 20 Federal Power Commission applications for permits and licenses to build hydroelectric projects; and 58 Department of Agriculture watershed work plans.

Bureau of Reclamation

Floyd E. Dominy, *Commissioner*



In carrying out its construction activities for fiscal year 1962, the Bureau of Reclamation of the Department of the Interior moved vigorously forward in its program of developing water and land resources in the Western United States and made important contributions to the expansion of the Nation's resource base. Construction contracts totaling more than \$150 million were completed on Reclamation project works, representing an investment in dams, irrigation canals, power and pumping plants, electric transmission lines, and other facilities available to serve the West and the Nation.

Construction completed during the year added more than 178,000 acre-feet of water storage in new Reclamation project reservoirs; 95,000 kilowatts of hydroelectric generating capacity; 335 miles of canals, pipelines, laterals, and drains; 15 pumping plants; and 375 miles of high-voltage transmission lines.

The total value of all contracts awarded in fiscal year 1962 amounted to about \$182 million, comprising the total value of more than 1,260 separate contracts for construction, materials, equipment, and supplies. Of this total amount, construction contracts accounted for about \$167 million, or about 92 percent. The 215 construction contracts in force at the end of the fiscal year had a total value of about \$477 million.

Bureau of Reclamation program accomplishments in a year of record endeavor reached 86.3 percent of fiscal year 1962 program objectives under its direct control. This is the best level of performance achieved by the Bureau in its 60-year history. One region—Region 5—accomplished 93 percent of its program objectives.

Total expenditures for the fiscal year, including the loan program and funds transferred to other agencies, amounted to \$347 million, also a record.

The fiscal year 1962 program was accomplished with an average Bureau employment of less than 11,000 employees, compared with an average maximum of as high as 19,000 employees in previous years.

The fiscal year will be remembered for the completion of Sherman and Red Willow Dams on the Missouri River basin project, both in Nebraska, and Paonia Dam on the Paonia project in Colorado. On the Central Valley project in California, construction was completed on the 17.5-foot-diameter, 11-mile-long Clear Creek tunnel, one of the longest irrigation tunnels in the world. On the Boulder Canyon project, Arizona-Nevada, the 95,000-kilowatt unit N-8 was installed in the Hoover powerplant, bringing the plant to its full capacity of 1,344,800 kilowatts.

The fiscal year was highlighted by the start of construction of seven major storage dams and three diversion dams—Sanford Dam, Canadian River project, Texas; Cheney Dam, Wichita project,



The first rock is blasted from the canyon walls of Gunnison River, Colo., at ground-breaking ceremonies for Blue Mesa Dam.

Kansas; Blue Mesa Dam, Curecanti unit of the Colorado River storage project, Colorado; Causey Dam, Weber Basin project, Utah; Clark Canyon Dam, Missouri River basin project, Montana; Norman Dam, Norman project, Oklahoma; Bully Creek Dam, Vale project, Oregon; Red Bluff Diversion Dam, Central Valley project, California; Barretts Diversion Dam, Missouri River basin project, Montana; and Florida farmers ditch diversion dam, Florida project, Colorado.

The year was notable also for the placement of the three-millionth cubic yard of concrete in the 4,865,000-cubic-yard Glen Canyon Dam in May 1962, and by the placement of 730,000 cubic yards in the 970,000-cubic-yard Flaming Gorge Dam, both major features of the Colorado River storage project, in Arizona and Utah, respectively.

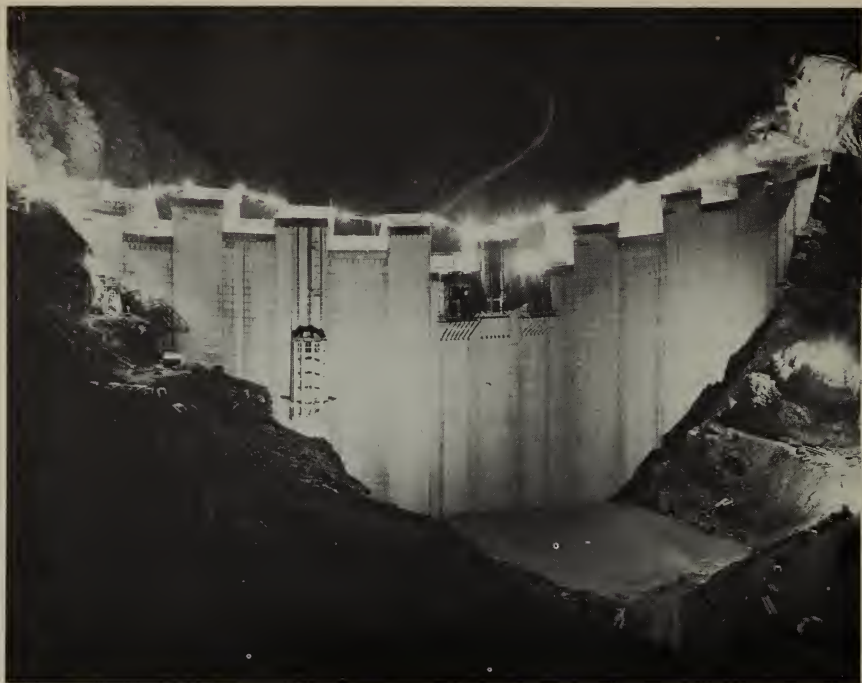
Other important construction activities on the five-State storage project were the awarding of the contracts for completion of the Glen Canyon Dam, switchyard, and powerplant, and for the completion of the Flaming Gorge powerplant and switchyard. Construction of the 26-million-cubic-yard earthfill Navajo Dam on the storage project in New Mexico was essentially completed by the end of the fiscal year, the first major storage feature to be completed on the project.

A signal accomplishment of the year was the awarding of five contracts, each having a value of more than \$1 million, for construction of transmission lines on the Colorado River storage project. Among these contracts was the \$12,847,830 contract for construction of the 240-mile line to extend from Glen Canyon powerplant in northern Arizona to Pinnacle Peak in the same State. The voltage of the line—345,000 volts—will be by far the Bureau's highest.

The "Statistical Appendix to the Annual Report of the Commissioner" contains complete annual and cumulative data on the Bureau's irrigation, municipal water, and power accomplishments, measured in both dollars and physical units, together with related investigations, construction, operation, and administration information.

Construction Highlights

A significant construction event of the fiscal year was the placement of the three-millionth cubic yard of concrete in the Glen Canyon Dam on May 15, 1962. The 710-foot-high concrete arch dam is the key feature of the Colorado River storage project and is under construction on the Colorado River in northern Arizona. By June 30, about 3,210,000 cubic yards had been placed in the dam, which will have a total volume of 4,865,000 cubic yards when it is completed. By



Night view of Flaming Gorge Dam on Green River in Utah as construction passes the three-quarter mark.

the end of the fiscal year, the dam was completed to a height of about 445 feet above the lowest point in its foundation.

Also at the dam, installation of the four steel river outlet-works pipes was completed, and installation of the eight steel penstocks to convey water to the turbines of the 900,000-kilowatt Glen Canyon powerplant was essentially completed. Late in the fiscal year, a contract was awarded for completion of Glen Canyon powerplant, switchyard, dam, and appurtenant works.

Flaming Gorge

On the Flaming Gorge unit of the Colorado River storage project on the Green River in Utah, a total of approximately 730,000 cubic yards of concrete had been placed in Flaming Gorge Dam by the end of the fiscal year. When completed, the concrete-arch dam will have a total volume of 970,000 cubic yards. By June 30, the dam stood 342 feet high above its foundation; total height of the structure is to be 502 feet.

Clearing of the reservoir area at the Flaming Gorge site progressed rapidly, and as of June 30 was about 96 percent completed in 66

percent of the contract time. The contractor for the completion of the 108,000-kilowatt Flaming Gorge powerplant and switchyard began excavation work on the switchyard extension in April 1962. In June he proceeded with work within the powerplant.

Navajo Dam

Another major feature of the Colorado River storage project, the 408-foot-high earthfill Navajo Dam on the San Juan River in New Mexico, was 96 percent completed by the end of the fiscal year—the first principal storage feature of the project to be completed. The 25-millionth cubic yard of a total of 26,250,000 cubic yards was placed on May 22, 1962. The outlet works and spillway were essentially completed. The diversion tunnel in the dam was closed late in the fiscal year to permit the start of filling of the 1,709,000-acre-foot reservoir, which will extend a considerable distance into southwestern Colorado.

Construction of the roadbed for the relocation of the Denver & Rio Grande Western Railroad and relocation of county roads around the reservoir were completed in July 1961. Laying track and bal-



Storage begins in Navajo Reservoir on the San Juan River, N. Mex., as Navajo Dam nears completion.

lasting for the railroad relocation was started in April 1962, and was about 75 percent completed by June 30.

A major step forward in the development of the Colorado River storage project was the start of construction, in April 1962, of the 342-foot-high, 3-million-cubic-yard earthfill Blue Mesa Dam and 60,000-kilowatt Blue Mesa powerplant on the project's Curecanti unit in western Colorado. Construction of Government camp facilities for the dam was started in November 1961. The water supply and sewage disposal systems were completed in April 1962, and the office and laboratory building, warehouse, and garage were nearly completed as of June 30, 1962.

Transmission System Advances

Progress of development of the Colorado River storage project was highlighted by the advancement of construction of more than 1,000 miles of high-voltage lines which are to be interconnected in a vast power grid and will transmit power from the project's powerplants to widespread areas in the Upper Colorado River Basin States.

These lines, in various stages of construction at the end of the fiscal year, were: Glen Canyon-Flagstaff-Pinnacle Peak (Ariz.), 345-kilovolt, 240 miles; Glen Canyon-Shiprock (Ariz.-N. Mex.), 230-kilovolt, 182 miles; Curecanti-Craig (Colo.), 230-kilovolt, 180 miles; Cortez-Curecanti (Colo.), 230-kilovolt, 101 miles; Shiprock-Cortez (N. Mex.-Colo.), 230-kilovolt, 42 miles; Flaming Gorge-Vernal-Rangely (Utah-Colo.), 138-kilovolt, 85 miles; Rangely-Oak Creek (Colo.), 115-kilovolt, 115 miles; Blue Mesa-Curecanti, Morrow Point-Curecanti, Curecanti-Montrose (Colo.), 115-kilovolt, 39 miles; Blue Mesa-Gunnison (Colo.), 115-kilovolt, 22 miles; Kremmling-Green Mountain (Colo.), 115-kilovolt, 10 miles; Kremmling-Gore Tap (Colo.), 69-kilovolt, 8 miles.

Participating Projects

Construction of the participating projects of the Colorado River storage project, to develop water for use within the respective States of the basin, was noted by the completion of the earthfill Paonia Dam on the Paonia project in western Colorado. Following completion of the 1,266,000-cubic-yard dam in January 1962, and filling of the 21,000-acre-foot reservoir during the spring runoff, the Paonia project was transferred by the Bureau of Reclamation to the North Fork Water Conservancy District. The project is the first participating project of the storage project to be turned over to a water users' organization for operation.

Work advanced on five other participating projects of the storage project—central Utah project, Utah, Florida and Smith Fork projects, Colorado, Seedska-dee project, Wyoming, and Hammond project, New Mexico. Construction of 11 miles of the Steinaker service canal and laterals on the central Utah project was started in April 1961, and completion is anticipated early in fiscal year 1963. Rehabilitation of farm ditches along the Steinaker feeder canal was begun in October 1961, and completed in January 1962.

Work on the Florida project was initiated in July 1961, with the beginning of construction on the 215-foot-high, 3-million-cubic-yard earthfill Lemon Dam. By the end of the fiscal year, 50 percent of the contract work was completed. Excavation of the outlet-works tunnel, gate chamber, and access shaft was completed during the fiscal year and concrete lining was being placed at year's end. Excavation for the spillway structure was completed and placement of concrete was begun. Construction of the county road relocation at the damsite was about 2.5 percent completed by June 30, 1962. In May of the same year, clearing of right-of-way for the Florida farmers ditch diversion dam and ditch enlargement and enlargement of the Florida Canal were started.

On the Smith Fork project, placement of embankment for the 160-foot, 855,000-cubic-yard, earthfill Crawford Dam was begun in September 1961, after diversion of Iron Creek through the outlet-works tunnel. Placement of concrete in the outlet works structures and spillway structure was completed. Placement of dam embankment as of June 30, 1962, was about 90 percent completed. Construction of the first section of the Aspen Canal and Smith Fork siphon was begun in June 1961, and was completed in June 1962. Work on the Smith Fork Diversion Dam and the remainder of the Aspen Canal was started in August 1961, and was about 90 percent completed by June 30, 1962.

Construction of the Fontenelle Dam on the Seedska-dee project began in July 1961, and was about 30-percent completed by the end of the fiscal year. The dam is an earthfill structure, to be 127 feet high and have a volume of 5,300,000 cubic yards. The access road at the dam was completed in October 1961. Construction of Government community facilities at the dam continued throughout the fiscal year; five contracts for the community facilities were completed, and two other contracts were in progress at the end of the fiscal year.

Work on the Hammond diversion dam on the Hammond project, New Mexico, including a part of the main canal, was completed in March 1962, and the Hammond pumping plant and penstock, bypass, and discharge lines were virtually completed by June 30, 1962. Construction of the second section of the Hammond main canal, east

highline laterals, and west highline laterals was begun in July 1961, and was essentially completed by the end of June 1962.

Pacific Northwest

In the Pacific Northwest, construction on the Wenatchee division of the Chief Joseph Dam project, Washington, was noted by completion of the river and booster pumping plants. Construction of the 2.4-mile-long discharge pipeline was virtually completed. The electrical distribution and control line to the plants was essentially completed, and the pipelines, pumping plants, and regulating reservoirs for Laterals 1 through 10 of the east unit lateral system were about 97 percent complete at the end of June 30, 1962.

On the Columbia Basin project, also in the State of Washington, construction of irrigation facilities was advanced, bringing to a total 450,000 acres available for irrigation. Construction of the Hope Valley and Frenchman Hills pumping plants and their discharge lines in the west canal lateral system was completed in November 1961. The block 80 lateral system, also in the west canal lateral system, was completed in December 1961. Three contracts for enlargement of the Potholes Canal were started during the winter and completed during the nonirrigation season. Construction of block 23 laterals and wasteways for the Wahluke Branch canal laterals was started in January 1962, and is scheduled to be completed by April 1963. Work was started in May 1962 on additions to the White Bluffs pumping plant No. 2 and construction of the switchyard.

Construction of the Ochoco relift and Barnes Butte pumping plants on the Crooked River project in Oregon was completed in September 1961, and the Lytle Creek diversion dam and wasteway were completed in February 1962.

A new start of the fiscal year was the 104-foot-high, 1,025,000-cubic-yard, earthfill Bully Creek Dam and feeder canal on the Vale project in Oregon. The work was started late in the fiscal year and is scheduled to be completed by May 1964.

California

Reclamation construction in California was noted by the completion of the 11-mile-long Clear Creek Tunnel on the Trinity River division of the Central Valley project after 5 years of intensive construction activity. Clearing of the Trinity Reservoir area was completed in December 1961. Relocation of the last section of Trinity County roads around the reservoir was completed in May and construction of a final link from the dam to the road system was about 50 percent complete by the end of the fiscal year.



Water from the Trinity River in northern California will pass through penstocks of the Clear Creek powerplant on its way to California's Central Valley.

Construction advanced on the Trinity River division's three large powerplants—Trinity, Clear Creek, and Spring Creek powerplants. Construction of the Trinity powerplant (100,000 kilowatts) structure and penstocks was completed in December 1961, and the contractor for installation of the turbines and completion of the powerplant began work in January 1962. At the time work was shut down by strike, the first week in May 1962, tunnel 2 of the Spring Creek con-

duit was almost completely lined, and steel lining and concrete encasement were about two-thirds completed for the Rock Creek siphon.

Construction of the Clear Creek powerplant (134,000 kilowatts) structure was completed in December 1961, and the contractor for installation of the turbines and completion of the powerplant began work the first week in January 1962. The Spring Creek powerplant (150,000 kilowatts) structure was completed, and the completion contractor was permitted to start installation of the turbines in March 1962. Installation of the Spring Creek penstocks was completed in May 1962, and only minor work remained unfinished when the work was shut down by strike early in May.

Also on the Trinity River division, construction of the Whiskeytown Dam was 67 percent completed by June 30, 1962. The earthfill structure will be 270 feet high and have a volume of 4,463,000 cubic yards. The flow of Clear Creek was diverted through the outlet works for the dam during November 1961; subsequent work was stopped by a strike early in May. Clearing of the Whiskeytown Reservoir area was about 75 percent complete by the end of June.

The embankment for the Trinity River division's earthfill Lewiston Dam (height, 80 feet; volume, 429,000 cubic yards) was largely completed. The spillway structure was about 35 percent completed. Concrete placement in the outlet works and powerplant structures was substantially completed when work was suspended by a strike early in May. Clearing of the Lewiston Reservoir site was completed in October 1961. Construction of the Trinity River Fish Hatchery adjacent to the Lewiston Dam was about 60 percent completed at the end of June 1962; work continued on various concrete structures, erection of buildings, and installation of pipelines and equipment.

Construction of the 190-foot-high, 1,866,000-cubic-yard earthfill Spring Creek Dam and its tailrace into the existing Keswick Reservoir was started in July 1961. The flow of Spring Creek was diverted through the outlet works in April 1962, and full-scale embankment work was in progress for 2 weeks until stopped by strike in May 1962. The work was 33 percent complete at that time.

A contract for additions to the 230-kilovolt Keswick switchyard to tie in the powerplants of the Trinity River division was about 95 percent complete by the end of June 1962. Construction of the 26-mile, 230-kilovolt transmission line to tie Trinity, Clear Creek, and Spring Creek powerplants into the Keswick switchyard was about 50 percent complete at the end of June, and is to be completed by December 1962. A 22-mile-long section of the Keswick-Gas Point Road-Cottonwood 230-kilovolt transmission line was started in January 1962 and was 25 percent complete by the end of June. Construction of the



Red Bluff Diversion Dam, now under construction on the Sacramento River as part of the Central Valley project, California—artist's conception.

Gas Point Road-Elverta, Elverta-Hedge, and Hedge-Tracy 230-kilovolt transmission lines, totaling 222 miles in length, was started in April 1962, and was about 5 percent completed by the end of June.

Central Valley

On the American River division of the Central Valley project, the first section of pipelines, structures, and reservoirs for the El Dorado distribution system was completed in March 1962; work on the second section was started in November 1961, and was about 30 percent complete by the end of June 1962. Work on a contract for Diamond Springs main, feeder line, and laterals was started in January 1962, and was about 15 percent completed by the end of June; an additional contract was awarded at the end of April. At the end of the fiscal year, chlorination and water-treatment facilities were completed at several reservoirs of the system.

Construction of pipelines and pumping plants for the Stone Corral Irrigation District of the Friant-Kern Canal distribution system on the Central Valley project was completed in March 1962. The part 1 extensions for the Madera distribution system were completed in January 1962, and the part 2 extensions were completed in June.

An important new start on the Central Valley project's Sacramento River division was the Red Bluff diversion dam, begun in March 1962.

Construction of the dam was shut down by strike early in May; the dam was about 10 percent completed.

Also in California, work on the Prosser Creek Dam of the Washoe project was about 85 percent completed by the end of the fiscal year. The dam is an earthfill structure and is to have a height of 157 feet and a volume of 1,738,000 cubic yards.

Nevada

The Bureau's progress in development of hydroelectric power resources was underscored at the Hoover powerplant on the Boulder Canyon project, Arizona-Nevada.

Installation of the 95,000-kilowatt generating unit N-8 in the Nevada wing of the powerplant was completed and the unit placed in service November 30, 1961, bringing the plant to its full generating capacity of 1,344,800 kilowatts.

Colorado

On the Collbran project in western Colorado, construction of the Upper and Lower Molina powerplant structures, penstocks, and equalizing reservoirs was completed in October 1961. Construction of the Upper Molina-Lower Molina 115-kilovolt transmission line, the Upper Molina equalizing reservoir, and Bonham-Cottonwood 12.47-kilovolt joint power and telephone lines was completed in November 1961. Completion work on the Upper and Lower Molina powerplants and switchyards was virtually completed by the end of the fiscal year.

The contract for the East Fork diversion dam, East Fork feeder canal, and rehabilitation of Bonham Dam was begun in July 1961, and as of June 30, 1962, was about 76 percent completed. Bonham Dam was essentially completed and the dam restored to service before work was closed down for the 1961-62 winter. Work on the diversion dam and feeder canal is to be completed during fiscal year 1963.

Utah

In Utah, construction progress on the Weber Basin project was marked by the virtual completion of the second stage of construction of the earthfill Willard Dam and by the award of the contract late in the fiscal year for the third and final stage of construction. When completed, the dam will have a total volume of 13 million cubic yards and will be more than 14 miles long—the Bureau's longest dam. Construction is to begin early in fiscal year 1963 on another project earthfill structure, Causey Dam, which will be 200 feet high and have a volume of 1,400,000 cubic yards.

Construction of the Willard Canal pumping plants Nos. 1 and 2 was begun in August 1961, and as of June 30, 1962, the work was approximately 50 percent completed. Earthwork on the Willard Canal and intake channel was nearly completed by the end of June, and placement of concrete in both pumping plants was in progress at that time. Construction of the first stage (6 miles) of the Willard Canal was completed in March 1962. Construction of the final stage (8 miles) of the canal is scheduled to begin early in fiscal year 1963. Pipeline and reservoir construction for the North Davis laterals, unit 1, was completed in August 1961. Construction work on the North Davis laterals, unit 2A, was begun in June 1961, and as of June 30, 1962, was approximately 60 percent completed. Construction of the North Davis laterals, unit 2B, was begun in July 1961, and as of June 30, 1962, was approximately 85 percent completed. Construction work on the West Farmington lateral system was completed in September 1961. Pipelines and structures for the Woods Cross laterals, part 2, were placed under construction in March 1962, and as of June 30, 1962, were approximately 30 percent completed.

Texas

An important undertaking in Texas was the start of construction in February 1962, on the Sanford Dam on the Canadian River project in the northwestern part of the State. This earthfill structure will be 228 feet high and have a volume of 14,800,000 cubic yards. Placement of the dam embankment began in May, and by June 30 about 7 percent of the work had been accomplished.

Also in Texas, work on the 134-foot-high, earthfill Twin Buttes Dam of the San Angelo project was about 93 percent completed in 68 percent of the contract time as of June 30, 1962. Approximately 18 million cubic yards of embankment of the required 21 million cubic yards had been placed. Placement of concrete in the outlet works and spillway was essentially completed. Clearing of the Twin Buttes Reservoir site was completed in March 1962. Construction of earthwork, concrete lining, and structures for the San Angelo main canal was begun in June 1961, and was about 90 percent completed by June 30, 1962. All canal excavation has been completed and placement of concrete canal lining progressed at the fiscal year's end. In October 1961, work was begun on the earthwork, concrete lining, and structures for the San Angelo distribution system. Approximately 75 percent of the work had been accomplished by the end of June.

Oklahoma and Kansas

In Oklahoma, on the Washita Basin project, construction of earthwork, concrete and steel pipe, and structures for the 38-mile-long Foss aqueduct and 13 miles of the Clinton, Bessie, and Cordell laterals was completed in June 1962. Work on Foss pumping plants Nos. 1, 2, and 3, and the erection of three steel water tanks for Foss aqueduct were also completed in June. Construction of recreational facilities for the Foss Reservoir was completed in October 1961.

In Kansas, a major new undertaking was start of construction of the earthfill Cheney Dam on the Wichita project. When completed, the dam will be 86 feet high and have a volume of 7,900,000 cubic yards. Work on the dam was about 5 percent completed by the end of June 1962.

Missouri River Basin

In Montana, on the Missouri River basin project, construction advanced on the 520-foot-high, concrete-arch Yellowtail Dam, largest concrete dam to be undertaken thus far by the Bureau of Reclamation on the farflung project. By the end of the fiscal year, construction of the dam and the 200,000-kilowatt Yellowtail powerplant at the toe of the dam was about 18 percent completed. The diversion tunnel was "holed through" in March 1962, and placement of concrete lining was started in May. Excavation of the inclined portion of the spillway tunnel and erection of the contractor's concrete and aggregate plant continued. Eight contracts were completed during the fiscal year for construction of community facilities for the Yellowtail Dam Government camp.

On the East Bench unit of the Missouri River basin project, also in Montana, relocation of 15.2 miles of the Union Pacific Railroad for Clark Canyon Reservoir was essentially completed by June 30, 1962. Construction of the 158-foot-high, 1,845,000-cubic-yard, earthfill Clark Canyon Dam was begun in November 1961, and by June 30, 1962, about 15 percent of the work had been completed. In October 1961, construction of the Barretts diversion dam and the first section of the East Bench canal and laterals was begun. By the end of the fiscal year, about 45 percent of the work had been accomplished. Work on the second section of the East Bench canal and laterals was started in June 1962.

Frenchman-Cambridge

Construction on the project's Frenchman-Cambridge division in Nebraska was highlighted by the completion in February 1962 of the

Red Willow Dam, an earthfill structure 127 feet high and having a volume of 3 million cubic yards. Final clearing of Red Willow Reservoir was completed in April 1962. Also completed was the second section of the Culbertson extension canal and lateral system. Earthwork and structures on the Cambridge subsurface drains were completed in September 1961. In January 1962, construction was begun on the Red Willow canal and lateral system, and by June 30 the work was about 40 percent completed. In April 1962, the contractor started clearing and stripping for the Red Willow diversion dam, including a short section of the Red Willow Canal.

On the project's Farwell unit, also in Nebraska, construction of Sherman Dam was completed in January 1962. The earthfill dam has a height of 130 feet and a volume of 1,748,000 cubic yards. Work on the Arcadia diversion dam, including a short reach of the Sherman feeder canal, was completed in June 1962. The remainder of the Sherman feeder canal was about 95 percent completed by the end of June 1962. Work on the concrete highway bridge and 10 county road bridges along the Sherman feeder canal was completed in December 1961. Construction of earthwork, surfacing, and a concrete bridge for the relocation of a secondary road at Sherman Reservoir was completed in November 1961. Construction of the Farwell main canal and laterals, Farwell central canal, and Farwell lower main canal and laterals progressed under three contracts. As of June 30, one contract was about 80 percent completed, another contract was about 50 percent completed, and the third contract was about 5 percent completed.

Merritt Dam

Construction of Merritt Dam and access road on the Ainsworth unit of the Missouri River basin project, in Nebraska, was about 40 percent completed as of June 30, 1962. Work on the access road was essentially completed. In April 1962, construction of earthwork, concrete lining, and structures for section No. 1 of the Ainsworth Canal was begun and by the end of June was approximately 20 percent completed. Construction of earthwork, concrete lining, and structures for section No. 2 of the canal was begun in June 1962.

On the project's Cedar Bluff unit, in Kansas, work on the canal outlet works for Cedar Bluff Dam was completed in August 1961. Construction of the first section of the Cedar Bluff Canal was completed in April 1962, and work on the second section of the canal was substantially completed by the end of June 1962. Work on the third section of the canal, including a lateral system, wasteway, and drains, was begun in June 1962.

Construction on the project's Kirwin unit, also in Kansas, was noted by completion of earth lining in selected reaches of the existing Kirwin Canal in December 1961. In April 1962, work was begun on the placement of earth lining in existing reaches of the Kirwin main, Kirwin north, and the Kirwin south canals. By the end of June, about 40 percent of the work had been accomplished. Construction of earthwork and structures for the Osborne lateral and drains began in April 1962, and was about 40 percent completed by June 30.

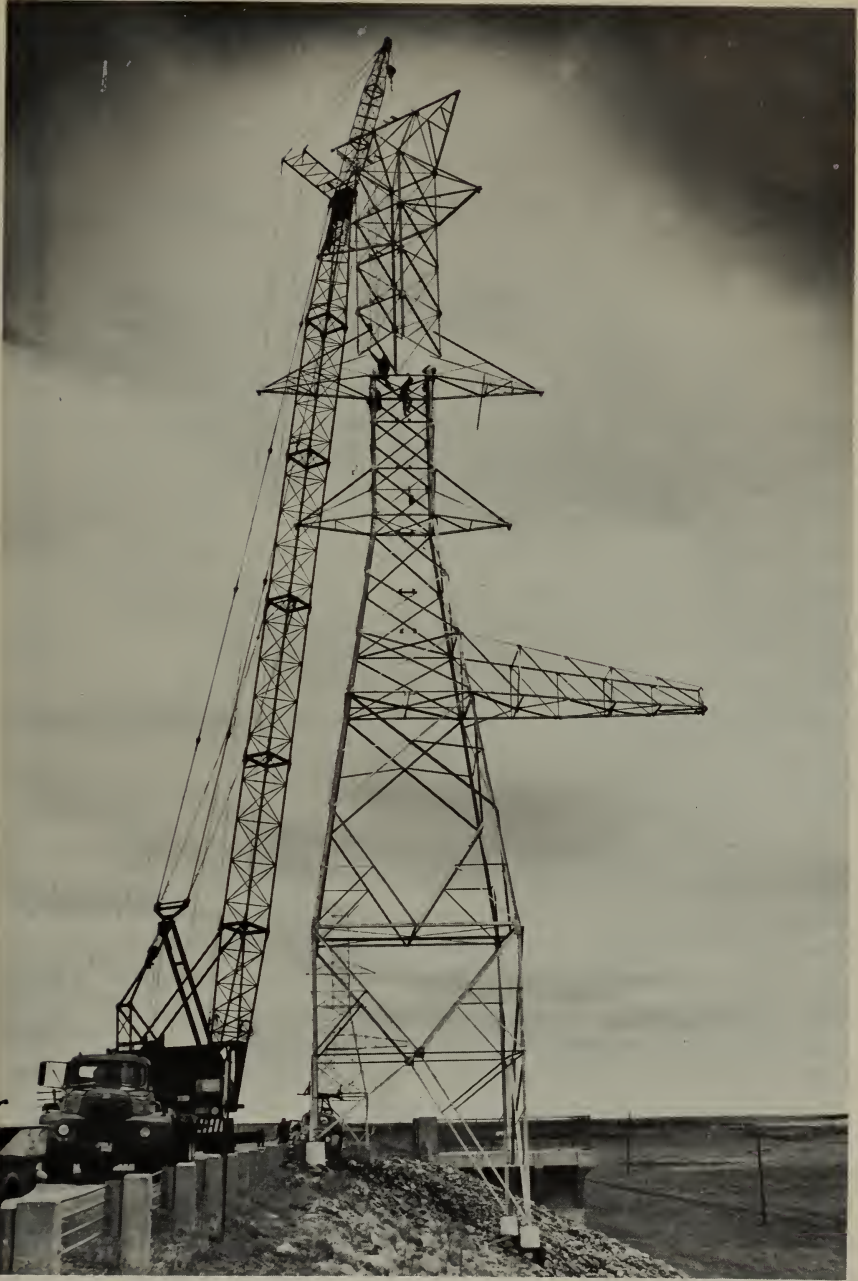
In November 1961, first major work was begun on the Almena unit of the Missouri River basin project in Kansas—the relocation of 13.8 miles of the Chicago, Rock Island & Pacific Railroad, and connections to the Chicago, Burlington & Quincy Railroad for Norton Dam. As of June 30, 1962, the work was about 50 percent completed. Construction of the unit's principal feature, Norton Dam, is expected to begin early in fiscal year 1963. The earthfill structure will have a height of about 100 feet and a volume of about 3 million cubic yards.

Missouri River Basin Transmission System

The fiscal year was outstanding for the considerable progress made in the construction of high-voltage transmission lines, substations, and related electrical facilities for the transmission division of the Missouri River basin project. The lines completed or under construction spanned varying distances in the States of Montana, North and South Dakota, Iowa, Minnesota, Wyoming, and Nebraska.

In Montana, construction of foundations and erection of steel towers for the 160-mile Dawson County-Custer section of the Yellow-tail-Dawson County 230-kilovolt line began late in the fiscal year. In North Dakota, construction of foundations and erection of steel towers for the 84-mile Jamestown-Fargo 230-kilovolt transmission line No. 2 were completed in November 1961. Stringing of conductors and overhead ground wires was begun in September 1961, and completed in April 1962. Construction of foundations and erection of steel towers for the 136-mile Garrison-Jamestown 230-kilovolt line, also in North Dakota, were completed in February 1962. Stringing of conductors and overhead ground wires was begun in June 1962. Construction of the 114-mile Garrison-Minot-Rugby 115-kilovolt line in the same State was completed in August 1961, and construction of 11 miles of the Jamestown-Grand Forks 115-kilovolt transmission line No. 1 was completed in September 1961.

In South Dakota, construction of foundations and erection of steel towers for the 57-mile Oahe-Fort Thompson 230-kilovolt line were completed in December 1961. Stringing of conductors and overhead ground wires for the Oahe-Fort Thompson line, the switch-yard approaches, and 1.42 miles of the Oahe-Midland line was begun



Erecting a triple circuit transmission tower in North Dakota adds another segment to the transmission system of the Missouri River basin project.

in September 1961, and by the end of June 1962, the work was essentially completed. Stringing of conductors for the second circuit additions for 337 miles of the Fort Thompson-Huron Watertown (S. Dak.), Fort Randall (S. Dak.)-Sioux City (Iowa), and Fort Randall-Fort Thompson 230-kilovolt transmission lines neared completion by the end of the fiscal year. Construction of 213 miles of the Sioux City-Spencer and Sioux City-Denison-Creston 161-kilovolt transmission lines (all in Iowa) also neared completion by the end of June 1962.

In August 1961, stringing of conductors for the second-circuit additions for 74 miles of the Watertown (S. Dak.)-Granite Falls (Minn.) 230-kilovolt line was started, and all work was completed by March 1962. Construction of the 88-mile Rapid City-Newell-Maurine 115-kilovolt line in South Dakota was begun in January 1962, and as of June 30, 1962, about 80 percent of the work was completed. Construction of the 75-mile Oahe-Eagle Butte 115-kilovolt line, also in South Dakota, was begun in March 1962, and was approximately 80 percent completed by the end of June 1962. Contracts for construction of the 65-mile Eagle Butte-Maurine 115-kilovolt transmission line and for construction of the 95-mile Winner-Mission-Martin 115-kilovolt transmission line, both in South Dakota, were awarded late in the fiscal year. Construction of the 65-mile Pine Bluffs-Sidney 115-kilovolt transmission line (Wyoming-Nebraska) was completed in October 1961.

Safety Program

The Bureau of Reclamation's concerted effort to carry out a vigorous and effective safety program was emphasized in fiscal year 1962 by the fact that the lost-time accident frequency rate of 7.6 by Government forces during the year represented a 21 percent improvement over the previous year. This was the lowest accident rate in Reclamation history. Time lost due to accidents was also the lowest in recorded Bureau accident history. This resulted in a reduction of \$215,000 in injury costs as compared with the previous fiscal year. Contractors on Reclamation projects reduced their accident frequency rate to 24.1, the lowest recorded for contractors on Reclamation projects. There was also a marked reduction in the number of fatalities among contractor forces as compared with the previous fiscal year.

Increased emphasis was placed on public safety to provide maximum protection to the public visiting Reclamation installations or exposed to the hazard of drowning in canals, laterals, and reservoirs. All Bureau properties were surveyed to assure compliance with safety standards for protection of the public. More than 1,000 field super-

visors received first aid instruction under a cooperative agreement with the Bureau of Mines. The Bureau of Reclamation became a member of the National Safety Council's fleet safety program to lower vehicle accidents and to provide driver participation in a nationally recognized safe-driver-award program.

Major Contracts Awarded

Table 1 lists the major contracts (more than \$1,000,000) awarded by the Bureau of Reclamation in fiscal year 1962. The largest—\$17,868,160—was for construction of the Sanford Dam on the Canadian River project in Texas.

Other major features for which contracts were awarded were the Blue Mesa Dam and powerplant on the Curecanti unit of the Colorado River storage project in Colorado, the 240-mile-long Glen Canyon-Flagstaff-Pinnacle Peak transmission line, Colorado River storage project in Arizona, the Gas Point Road-Elverta, Elverta-Hedge, and Hedge-Tracy transmission lines, totaling 222 miles, on the Central Valley project in California, and the completion of Glen Canyon powerplant, switchyard, dam, and appurtenant works on the Colorado River storage project, in Arizona.

Listed in table 2 are the principal features completed on Bureau of Reclamation projects in fiscal year 1962. The table includes three storage dams, two diversion dams, a major tunnel (Clear Creek), 335 miles of canals, pipelines, laterals, and drains, and 375 miles of transmission lines.

Engineering Design

Design schedules were met efficiently and promptly by improved design techniques and greater utilization of automatic computing devices in design analysis. Specifications for 89 construction contracts and 82 major supply contracts were completed during the fiscal year. More than 4,500 new drawings were prepared and over 1,500 "as-built" drawings were revised.

To obtain valuable data for use in design and selection of high-voltage transmission line towers for the unusual and extreme weather and foundation conditions encountered in the West, the Bureau awarded contracts for fabrication and testing of a variety of experimental transmission line towers. The towers are to be installed in a 7-mile section of the 182-mile-long, 230-kilovolt transmission line extending from the Glen Canyon powerplant to Shiprock, N. Mex. In this assessment of whether improved types of structurally sound

towers can be developed for easier and more economical installation, the Bureau is particularly interested in developing lightweight towers that can be transported by helicopters to rugged and inaccessible areas and installed by helicopters.

Use of Computers

Significant progress was made in the application of electronic computers to engineering analyses and problems, leading to increased efficiency and economy in design work. A new electronic computer installed in the Bureau's engineering offices in Denver was used from 250 to 300 hours per month for calculations on engineering and scientific problems. New programs for electronic computer application were developed to solve, among others, the following major engineering problems: structural design analyses of slabs and two-dimensional frames; computation of earthwork quantities for canals, laterals, and pipe trenches; statistical analyses of field test data from earth and concrete dams; design of concrete-arch dams; determination of power flows in interconnected high-voltage electrical power systems; and analyses of hydrologic systems. The machine was also used to speed up calculations of earthwork quantities for highways and to aid in design studies of powerplants, pumping plants, spillways, and other structures.

To meet the many important responsibilities of the Bureau in carrying out its present and future water resource development programs more economically and expeditiously, an intensive study was made of the possible application of automatic data processing techniques to planning, design, irrigation and power operations, construction, and research activities. In inventorying the needs to strengthen and streamline the Bureau's technical effort through automatic data processing methods, a wide variety of problems were evaluated for potential solution by electronic computers. Among the more complex problems assessed for automatic machine analysis were coordinated operation of river, reservoir, and hydroelectric power systems on a basin and interbasin basis, project formulation studies, and optimization of project design.

Studies Aim at Economies

To effect economies in pipelines, design studies were made on the use of high-strength, deformed steel reinforcing bars in precast concrete pipe. As a result of these studies, a contract was awarded to perform hydrostatic and dynamic tests on full-size test specimens. If the tests confirm design analyses, considerable savings will be realized in future pipelines of medium to large size. Standardization

of designs of canal structures was extended during the fiscal year by the completion of standard designs for monolithic concrete closed conduits in sizes 96 through 144 inches in diameter.

Under study during the fiscal year was the bold new design for an extremely large generator having a capacity of about 300,000 kilowatts. The design study was undertaken, with cooperation from industry, to meet the anticipated requirements of new Reclamation developments where extremely large generating units would be most efficient and economical. Also under intensive study was extra-high (from about 400 to 800 kilovolts) voltage transmission of electrical power. The studies were directed toward both increased voltages for alternating current transmission and possible utilization of extra-high direct current for interties between large power producing areas and to large load centers.

Considerable savings in both operation and maintenance of pumping plant installations are to be realized by a new insulation system for pump motors developed by Bureau electrical designers. Use of the new insulation will obviate difficulties experienced by the absorption of moisture by previous pump motor insulations and the need for heaters which earlier had added considerable expense to operation of pumping plants.

A novel development having widespread potential application and holding promise of reducing costs was the design of a power device which utilizes the effect of the electrostatic field surrounding high-voltage transmission lines (230-kilovolt or higher). The device has sufficient continuous capacity to supply airway obstruction lighting on high towers, supply power service for lighting and operating small power tools, and energize remote communication facilities such as radio or microwave repeater stations.

The Bureau's program of modifying existing powerplants to provide for semiautomatic and centralized control devices and instruments progressed during the fiscal year to the extent that substantial savings in operating expenses are being achieved. Closed-circuit television was utilized for remote surveillance of powerplants and for security precautions at certain plants.

In mechanical design, a new 10-inch jet-flow gate was designed and fabricated for the outlet works at Whiskeytown Dam on the Central Valley project, California. The gate provides an economical, erosion-free regulation of small discharges. A new welded truss design was developed for the 60- by 18-foot fixed-wheel gates at Red Bluff Dam, resulting in a weight savings of about 17 percent, or about 150,000 pounds, for the 11 gates. In addition, serious downpull and hoisting problems were eliminated, and simpler field installation and maintenance were provided.

Miniature TV Utilized

Bureau geologists initiated procurement of a television borehole telescope to view the inside of dam foundation drill holes and to evaluate in-place geologic conditions. The television device can be inserted in the small-diameter (3-inch) drill holes commonly used in Bureau foundation exploration and thus provide data which cannot be obtained by any means other than expensive large-diameter drill holes or exploration shafts. The television borehole telescope will be used initially in investigations at the Morrow Point damsite in Colorado—the first application of the device to small-size drill holes in dam foundation exploration in the United States.

Engineering Reference Office Created

To keep abreast of the vastly expanding scientific and engineering writings in water resources development, the Bureau established during the fiscal year an Office of Engineering Reference. The Office, through information storage and retrieval methods, will aid Reclamation engineers and scientists in keeping informed of the technical literature relating to their work. The Office will be an important link in a developing national science information network.

Construction Awards and Costs

A total of 29 contracts, principally for electrical equipment, was awarded to companies offering foreign manufactured equipment or materials. These contracts, which totaled \$952,261, included those with eight Canadian, five West German, four South American, three English, two Japanese, two Italian, two Dutch, and one each with Austrian, Swedish, and Swiss firms. Twenty of the contracts were for electrical items; four were for electronic distance measuring instruments; two were for theodolites; two were for an evaporative retardant mixture; and one was for hoists. In accordance with regulations of the Department of the Interior, a differential was added to each bid offering foreign equipment or materials for comparison with domestic bids.

Construction costs on Bureau of Reclamation projects increased about 1½ percent during fiscal year 1962. For the same period, construction wage rates increased about 4 percent, while most construction material costs remained fairly stable.

Bidding interest in Reclamation construction work averaged 6.6 bids per schedule, which was essentially the same as for the preceding fiscal year. This compares with an overall average of 6.3 bids per schedule for the past 10 years.

The total of all low bids received for construction schedules was about 97 percent of the total for the engineers' estimates. The average of the three low bids for each schedule was about 103 percent of the engineers' estimates.

Table 3 shows cost indexes for Bureau of Reclamation construction work based on the combined costs of materials and labor supplied by the contractor, and materials and labor supplied by the Government.

Publications

Published during the fiscal year were the Technical Records of Design and Construction for Tiber Dam, Glendo Dam and Powerplant, and the Talent Division of the Rogue River Basin Project. Also published was the second edition of the Paint Manual, a practical reference work describing procedures for the control and application of paints and other protective coatings to structures.

Issued also were an engineering monograph on calculation of stress from strain in concrete and two technical memoranda covering simplified analytical solutions of transmission system problems and predicting return flow from irrigation. More than 250 laboratory reports were issued, embracing the subjects of research and testing of materials for concrete, hydraulic laboratory studies, earth materials investigations, research in bituminous materials, studies of weed control, and protective coatings investigations.

In response to 6,500 requests for the Bureau's publications and informational materials received from individuals in this country and in foreign countries, 33,000 copies of technical publications and informational pamphlets were sold or distributed. Sales of Bureau publications totaled \$37,500. About one-half of the total sales was made to foreign countries. Publications sold for the Superintendent of Documents, as his agent, totaled more than \$15,000.

Research Program

The Bureau's program of research continued to move forward in investigating new and economical methods and materials for use on Reclamation water resource developments.

Indicative of this intensive research effort was the undertaking early in 1962 of a program of weather modification research in cooperation with the National Science Foundation and the U.S. Weather Bureau. Contracts were awarded to three universities for research in support of the program, the long-range objective of which is to increase water supply on Reclamation projects through artificially

induced precipitation. The Bureau's immediate goal is to investigate, in cooperation with the universities and other research organizations, the mechanism of water transport by air masses and the inducement of precipitation from the air masses. The contracts are with the Natural Resources Research Institute, University of Wyoming; the Institute of Atmospheric Sciences, South Dakota School of Mines and Technology; and the Desert Research Institute, University of Nevada.

The Natural Resources Research Institute is conducting laboratory and field research on new methods and instruments for observing and studying meteorological conditions in Wyoming and South Dakota. The Institute of Atmospheric Sciences is performing research and classifying the ways that air masses in the Great Plains area transport water at different times of the year. The emphasis of this study is on meteorological conditions in South Dakota. The research also includes the investigation of materials and techniques for inducing precipitation from suitable moisture-bearing air masses. The Desert Research Institute is investigating methods of evaluating cloud-seeding experiments.



Fishing, camping, water skiing—Lake Mohave, Ariz.

Reservoir Evaporation Reduction

The fiscal year was noted by the advances made in the Bureau's 5-year research program in reservoir evaporation reduction, scheduled to continue through 1964. The goal is to develop practical evaporation-reduction techniques that can be used economically on storage reservoirs. The research effort was directed toward the improvement of the technique of placing a 1-molecule-thick chemical layer (monolayer)—about six ten-millionths of an inch—on reservoir surfaces as an evaporation retardant. The monolayer-forming materials under study are a mixture of hexadecanol and octadecanol, known as fatty alcohols. The compounds are tasteless, colorless, and harmless to humans, as well as to plants, animals, fish, and other wildlife.

In pursuing this research program, Bureau researchers carried out exhaustive tests in 1961, by applying 60,000 pounds of the chemical layer to the surface of the 3,090-acre Lake Cachuma during the hot summer months when evaporation was greatest. The reservoir is a feature of the Cachuma project in California.

Further steps in the research program were initiated by Utah State University under a contract with the Bureau of Reclamation. In the summer of 1961, the university began studies of the physical and economic feasibility of applying evaporation-retarding chemicals by low-flying aircraft. The university's research program, which is to continue through June 1963, seeks to develop equipment for aerial application of monolayer-forming materials, determine flight conditions favorable to aerial spraying of monolayers on water surfaces, investigate the economics of aerial application, study the behavior of aerially applied monolayers, and to work toward development of suitable techniques and equipment for field tests on a reservoir of approximately 5,000 acres.

Low-Cost Canal Linings

The Bureau intensified its research in low-cost canal lining development by testing in July 1961, a new type of chemical sealant to reduce seepage of valuable irrigation water along a 6.6-mile reach of a lateral on the Eden project in Wyoming. The sealant used in the test was a petroleum-based emulsion which was carried into the soil of the bottom and side slopes of the water-filled lateral. Eventually, the soil voids were filled to form a barrier or membrane to water seepage below the soil surface. Measurements taken 24 hours after treatment showed a reduction in seepage losses of 55 percent, and, 48 hours after treatment, the reduction was 66 percent. Determination of service life of the sealant is being studied.



Engineers test wax emulsion sealant to reduce seepage loss from irrigation canal, Eden project, Wyoming.

A further research effort to reduce canal seepage losses was undertaken early in 1962, on a $1\frac{1}{2}$ -mile section of irrigation lateral on the Tucumcari project in New Mexico. The lateral was lined with buried plastic membrane to control severe seepage. The plastic, one one-hundredth of an inch thick, was placed in sheets, with 1-foot overlaps. For installation, a few inches of earth were removed from the lateral section, the plastic laid, and then a blanket of earth was

placed over the plastic. In this way, the rehabilitated lateral will retain its original size and capacity.

In October 1961, two laterals on the Columbia Basin project in Washington were treated with a petroleum-based emulsion soil sealant to reduce water loss caused by seepage. At the time of treatment, seepage loss measurements were made to evaluate the effectiveness of the sealant. The tests showed reductions in seepage ranging from 44 to 82 percent immediately after treatment. Similar tests using petroleum-based emulsion sealants were initiated on laterals on Reclamation projects in California, Oregon, and South Dakota. The effectiveness of the sealants to reduce seepage is under continuing study.

Soil-Cement Facings

The fiscal year marked the 10th anniversary of the Bureau's program of study of the experimental soil-cement facing placed in 1951 on a test earth embankment adjacent to the Bonny Reservoir on the Missouri River basin project in eastern Colorado. The results of the study, after 10 years of periodic observations, indicated that soil-cement, properly designed and constructed, is competitive in cost and performance with rock riprap used to protect the upstream faces of earth dams against wave action of reservoirs.

As a result of the Bonny tests, soil-cement is being used as a substitute for rock riprap at Merritt Dam in Nebraska, where suitable rock for riprap is not locally available, and at the Cheney Dam in Kansas.

Subsidence Tests

To evaluate the expected rate of subsidence along critical reaches of the proposed San Luis Canal on the Central Valley project in California, Bureau researchers, late in 1961, began land subsidence tests along the canal line. The tests will provide basic data for estimating how much subsidence will occur when the soils of the area are wetted by irrigation water from the canal. Loose, highly porous soils of low density, which are known to subside with wetting, are found along some 20 miles of the 107-mile canal bed. Land subsidence in the area is a serious problem in the construction of irrigation canals, pipelines, and other engineering features which must stay on grade. At the conclusion of the tests, the Bureau will be better able to estimate how much time and water will be needed to compact the soils and avoid further sinking after the canal is in use.

Laboratory Investigations

Bureau laboratory investigators developed during the fiscal year a hydraulic-type pressure cell which shows considerable promise as an instrument for accurately determining earth pressures against rigid structures. A research program is in progress using this type of cell to evaluate pressures around pipes for many field-simulated conditions of bedding, backfill, and loadings. The findings of this study are expected to yield data for the improvement of design criteria for pipes and pipe systems and to lead to lower cost in pipe construction.

The application of radioisotope techniques to measure discharges in canals, streams, and closed conduits was under continuing study during the fiscal year. The techniques developed are expected to provide a simple and accurate method of measurement unaffected by the configuration of the canal prism or velocity of the flowing water. Devices employing radioisotopes to measure moisture content and density of soils were also under study to determine the suitability of such apparatus for subsurface exploration and construction control purposes.

Laboratory researchers continued their investigations to determine suitable applications and effectiveness of various plastics, silicones, epoxy resins, and other protective coatings for use in construction and maintenance of Reclamation structures. Various materials were investigated for possible application in concrete repairs and surface treatment to prevent deterioration from abrasion, freezing and thawing, and other weathering and erosion forces.

Investigations of concrete mixes were conducted to determine the effect of maximum size aggregate (sand and gravel) on compressive strength. The study indicated that it may be more economical to use smaller size aggregates depending upon the compressive strength desired. Progressively higher strengths were obtained with minimum cement content by the use of progressively smaller aggregates.

Measurements carried out in the Hydraulic Laboratory indicated that design procedures which are used successfully to compute the capacity of small and medium size canals are not adequate for large concrete-lined canals built on comparatively flat grades. Hydraulic losses in these canals are greater than had been anticipated. Both laboratory and field investigations were undertaken to acquire data to provide a firm basis for refinement of design procedures.

Research in weed control continued to place emphasis on aquatic weeds in large irrigation canals. By conducting tests under controlled conditions, Laboratory scientists continued to expand their knowledge about the response of aquatic weeds to herbicidal applications under varying light intensity, light quality, and water temperature. Studies

with antifouling paints for preventing the attachment of algae to irrigation structures indicated that the vinyl-base, high cuprous oxide content type of material to be an effective and durable coating for this purpose.

Project Development

The Bureau of Reclamation's project development program involves preparation of comprehensive plans for development of river basin resources and the investigation and planning of potential projects to meet the requirements of the fast growing population of the West for optimum utilization and conservation of its limited water resources. The program also includes detailed preconstruction studies on newly authorized projects.

The initial stage of the San Juan-Chama project and the Navajo Indian irrigation project were authorized for construction by the act of June 13, 1962, Public Law 87-483.

Comprehensive Basin Surveys

During the fiscal year, the Bureau, in cooperation with other agencies, was engaged in comprehensive surveys in 12 river basins throughout the West, including 2 subbasins of the Missouri River basin.

The Bureau and the Corps of Engineers completed a joint report on the Upper Snake River basin, Oregon-Idaho-Wyoming, which has been released to the public. Miscellaneous minor items of investigation in connection with other river basin surveys were also active.

Project Planning Reports

By the end of the fiscal year, project planning reports had been submitted to the Congress on the Waurika project in Oklahoma; Columbus Bend project in Texas; Arbuckle project in Oklahoma; the Auburn-Folsom south unit of the Central Valley project in California; Savery-Pothook project in Colorado-Wyoming; the Crooked River project extension in Oregon; and the upper division of the Baker project in Oregon.

Planning reports on the Buttes Dam and Reservoir, Middle Gila River project in Arizona, the Bostwick Park project in Colorado, and the North Loup division of the Missouri River basin project in Nebraska were transmitted to the Bureau of the Budget for advice as to their relationship to the President's program prior to submission to the Congress.

Planning reports on the Dixie project in Utah and on the Fruitland Mesa project in Colorado were under review by States and Federal agencies prior to submission to the Bureau of the Budget.

Definite Plans

During the fiscal year definite plan reports for authorized projects were completed on the Bully Creek extension of the Vale project in Oregon; the Silt project in Colorado and the Emery County project in Utah, both participating projects of the Colorado River storage project; the Norman project in Oklahoma; the Malaga Bend unit of the MacMillan-Delta project in New Mexico; the Glen Elder unit of the Missouri River basin project in Kansas; the South Gila Valley unit of the Gila project in Arizona; and the James diversion dam, Oahe unit, of the Missouri River basin project in South Dakota.

Review also has been completed by interested Federal agencies and the State of Alaska on the planning report for the Devil Canyon project. In connection with the report on the Crater-Long Lakes division of the Snettisham project, a plan for development by stages was adopted and submitted to the Congress for consideration.

Loan Program

The loan program continued very active, with a sharp increase in the number of applications received. Eight applications totaling \$15,726,100 for new small projects and two applications totaling \$974,000 for increases in small project loans previously made were approved. Four applications for new distribution system loans totaling \$45,232,800, and one for an increase of \$600,000 in a distribution system loan previously made were also approved. Among the small project loans approved were the first ones in the States of Oregon, Idaho, Colorado, and Hawaii.

Construction of five projects in the small projects program was completed during the year. Nine other small projects and two distribution systems were under construction. Repayment of loans under this program started during the year with the first payments by two organizations.

In total, from the start of the program to June 30, 1962, small project loans and grants of \$61,850,700 and distribution system loans of \$71,124,301 have been approved by the Secretary.

River Compacts

The Columbia River basin compact was approved by the compact commissioners of the several basin States on October 3, 1960. The compact has been ratified by all affected States except Washington

and Oregon, where bills for adoption have not yet been introduced.

The Lower Niobrara and Ponca Creek compact between Nebraska and South Dakota was ratified and is awaiting consent action by the Congress.

When called upon, the Bureau has continued to provide technical assistance with respect to negotiations on the following unperfected interstate compacts:

Arkansas River (Arkansas and Oklahoma).

Arkansas River (Kansas and Oklahoma).

Cheyenne River (Wyoming and South Dakota).

Little Missouri River (Wyoming, Montana, and North Dakota).

Upper Niobrara River (Wyoming and Nebraska).

Red River (Arkansas, Louisiana, Oklahoma, and Texas).

Truckee-Carson-Walker Rivers and Lake Tahoe (California and Nevada).

Big Blue River (Kansas and Nebraska).

Hydrology

The Hydrology Branch has continued to study the hydrologic aspects of proposed water resource development projects. These studies include, but are not limited to, evaluation of the quantity and quality of water supply in relation to the multiple-purpose requirements, determination of the amount of sediment load and its deposition, and potential flood magnitudes and frequencies as the basis of design.

Study of flood hydrology problems associated with proposed Reclamation projects was continued during the year by preparing design storm studies and inflow design flood and frequency studies for use in spillway design. Studies were continued of emergency operating rules for use in spillway design. Flood hydrology studies were also made to establish cross drainage criteria for proposed canal structures.

A hydrometeorological study of seasonal variation in probable maximum precipitation for small basins in western Colorado is in progress and nearing completion.

Flood control operating rules and agreements for several proposed and existing Bureau reservoirs were reviewed and coordinated with the Corps of Engineers.

A report was prepared to present current information on the use of irrigation water on selected projects and to illustrate the quality and extent of data obtained during usual project operation. A program is underway to obtain additional data needed to improve the planning, designing, and operating of irrigation projects.

Cooperative investigations of the effects of land treatment and conservation practice on yield of streams were completed with the

Agricultural Research Service and the Soil Conservation Service of the Department of Agriculture and a final report is being prepared.

Cooperative studies were continued with the Geological Survey to evaluate the amount of water transpired by phreatophyte growth and the amount of water that can be salvaged by eradication of the phreatophyte infestations.

Studies were continued on determining sediment distribution in a reservoir and unit weights of reservoir sediment deposits.

Extensive studies were conducted in the field of stable channels to improve the design criteria for earth-lined and unlined canals.

The electronic computer was used to determine total sediment loads by the Modified Einstein Procedure for several streams. An analysis was made of the problems associated with sediment excluding devices and settling basins, particularly with relation to determination of their efficiency and effectiveness.

A sediment survey was conducted of Harry Strunk Lake Nebr.

Assistance in all aspects of hydrology was given to the Blue Nile River investigations project of Ethiopia, in consultation with the Denver staff.

International Streams Investigations

The Bureau of Reclamation is represented on three international engineering boards of the International Joint Commission. Under the reference of January 12, 1948, the Souris-Red Rivers Engineering Board, through its engineering committee composed of interested Federal agencies, initiated a joint investigation of the possibilities of developing the Pembina River to the mutual advantage of the United States and Canada. The Board also continued the systematic collection and study of hydrologic data and related flood control and irrigation investigations in the Souris, Red, and Missouri River basins.

The International Pembina River Engineering Board was established by the Commission pursuant to the reference of April 3, 1962, to investigate and report upon what measures could be taken to develop the water resources of the Pembina River in the State of North Dakota and Province of Manitoba. The studies initiated under the Souris-Red Rivers reference were continued by the Pembina River Engineering Board under the Pembina River reference.

Irrigation and Land Use

The gross value of crops, which are reported on an annual, rather than fiscal year basis, produced on Reclamation projects in 1961

was \$1,114,876,461, the third successive year in which the farm value of crops grown exceeded \$1 billion. These crops were grown on 6,885,984 irrigated acres, resulting in an average gross crop return of \$161.91 per acre.

The irrigable areas of Reclamation projects increased 63,524 acres. This acreage was widely dispersed in the 17 Western States area where irrigation is necessary for full utilization of the land and water resource potentials.



Onions are among the many diversified crops produced on lands irrigated by Reclamation projects.

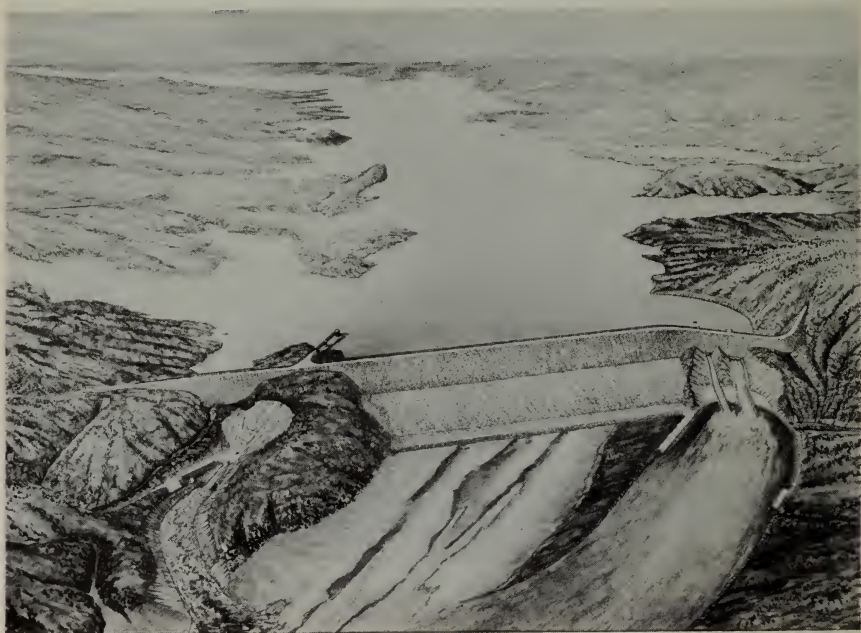
There were 128,433 irrigated farms on Reclamation projects; three-fourths of these were full-time farms and about one-fourth were part-time units. Total farm population was 514,079 persons, an average of 4 persons per farm.

The flexibility and stability of irrigation farming is evidenced by the shifts away from surplus crops and the continuing trend in yield improvement. The acreage in grain crops decreased 102,000 acres from 1960, and cotton and bean acreage declined about 36,000 and 7,000 acres, respectively. These decreases were largely offset by increased acreage of crops not in surplus supply. The principal

acreage gains over 1960 included 80,000 in sugar beets; 7,000 acres in mint; 22,000 acres in vegetables; 17,000 acres in fruit, and 20,000 acres in forage crops.

The 20 percent increase in acreage of sugar beets is the result of additional temporary domestic quotas of sugar. The recent amendment to the Sugar Act providing additional quotas to domestic producing areas should encourage further expansion in acreage of this crop and the building of processing facilities.

Notwithstanding lower prices for some of the important crops, the net reduction from the 1960 aggregate value of production was held to \$43 million by the offsetting effects of production increases and shifts of acreage to crops in higher demand.



Sanford Dam, now under construction on the Canadian River, will supply municipal water to 17 cities in northwestern Texas.

Water furnished for municipal and industrial uses from Reclamation project facilities amounted to 483.5 billion gallons, a 21-percent increase over 1960. A total of 37 projects in 13 States participated in the delivery of this water to 83 primary contracting entities which represent about 200 different groups of water users or large commercial enterprises. These contracting entities, in turn, serve about 9 million water customers.

The expansion of towns and cities brought the total urbanized project land area to 191,713 acres with a population of over a million persons now residing on these once-farmed lands.

An analysis of a mature irrigation project area indicates that from 170 to 240 local off-farm employment opportunities are generated for each 100 irrigation farmers and hired farmworkers. The income of these off-farm workers would range from \$200 to \$270 per \$100 of income accruing to the agricultural workers.

Repayment of Project Costs

Consistent with the policy of securing repayment contracts as a prerequisite to the initiation of construction of a project, repayment contracts were executed in fiscal year 1962 for an appropriate share of the reimbursable costs of such projects. There were also executed numerous water service contracts, both temporary and long term, as well as several adjustments of existing contracts to adopt variable repayment plans in accordance with the water users' ability to pay and to defer or reschedule construction charges in order to alleviate the financial difficulties encountered by water users because of extended drought, agricultural price conditions, and other factors.

Agreement was reached with the State of California for construction of the \$433 million joint-use facilities of the San Luis unit of the Central Valley project in California. Under this agreement the Bureau of Reclamation will construct the joint-use facilities, the State will operate them, and the cost of construction and operation and maintenance will be shared by the Bureau and the State. The State will advance 55 percent of the cost of constructing the joint works, with the remainder financed from Federal funds.

Also in the Central Valley project, a \$41 million distribution system loan repayment contract was approved for the Arvin-Edison Water Storage District. This represents the largest distribution system repayment contract in the 60-year history of the Bureau of Reclamation.

Considerable progress was made in the negotiations with the three irrigation districts in the Columbia Basin project in an endeavor to reach agreement on amendatory long-term contracts which would place that project on a basis similar to Federal Reclamation projects generally. In the meantime a short-form of amendatory contract has been approved for the Quincy-Columbia Irrigation District, and good progress is being made in negotiations with the other two districts. Legislation to approve contract arrangements was pending before the Congress as the fiscal year ended.

Contracts Executed

A repayment contract was executed prior to initiation of construction of the \$18 million Norman project in Oklahoma. This new project is to supply municipal and industrial water to three Oklahoma cities.

The Bureau has been involved almost continuously this fiscal year in problems concerning repayment arrangements for the third division of the Riverton project in Wyoming. The President has signed Public Law 87-479, permitting the continued delivery of water to this district during calendar year 1962. Meanwhile, efforts are continuing to work out a permanent solution to these problems.

The President also has approved H. R. 9647 (P. L. 87-472), authorizing execution of amendatory contracts with the Burley Irrigation District and with the Minidoka Irrigation District, both in Idaho. These contracts take into account power revenues and costs with assurance to the water users of a future power supply.

A \$4,514,000 small Reclamation projects loan repayment contract is being negotiated with the State of Hawaii for completion of the proposed Molokai project. This is the first contract to be negotiated by the Bureau of Reclamation in the new State of Hawaii.

Constant effort is made in the execution of new and the administration of existing repayment contracts, to take into consideration the repayment ability of the water users based on current economic conditions in order to insure that no undue burden is placed on them, and at the same time that the reimbursable costs of all projects are returned to the United States in accordance with established and new Reclamation laws.

The value of all repayment contracts on June 30, 1962, amounted to \$1,122,421,903. Of this amount, a total of \$168,703,134 has been paid and delinquencies were insignificant.

Recreational Use of Projects

Recreational use of Reclamation projects totaled 25.6 million visitor days during calendar 1961. This was an increase of 1.3 million over the 24.3 million visitor days of such use in 1960. Recreational use of Reclamation projects during the past decade has approximately quadrupled. The pattern of use by activities during the year was about the same as in previous years, with totals in the order of their importance as follows:

<i>Activities</i>	<i>Number of visitor days</i>	<i>Activities</i>	<i>Number of visitor days</i>
Sightseeing-----	10, 697, 474	Swimming-----	1, 738, 211
Fishing-----	4, 524, 504	Camping-----	1, 613, 859
Boating and water skiing--	3, 491, 831	Hunting-----	330, 954
Picnicking-----	2, 758, 487	Other-----	422, 359



Recreational use of Canyon Ferry Lake, on the upper Missouri River near Helena, Mont., reached 45,000 visitor days in 1961.

Use was greater in 1961 than in 1960 in all activities except boating and water skiing and hunting. Decreases in these activities were undoubtedly associated with water shortages which occurred on many projects during 1961, resulting in smaller late-season water areas.

The use data reported do not include recreation which occurred on project farmlands and other project areas outside of those areas managed for recreational use. This unreported use, however, is substantial and is undertaken mainly by local and semilocal residents. On some projects, recreation use not reported may equal reported use at reservoirs and other established recreation sites. Increasing recreational use of Reclamation facilities continues to emphasize the inadequacies of such facilities on many projects. The emphasis is further magnified by disparities between the old—and undeveloped for recreation—projects and the new projects on which the Congress has provided authority to meet recreation needs more adequately. Recreationists continue to point out these disparities.

Steps were taken during 1961 to correct the inequitable situation with respect to recreation development on Reclamation projects. The new policy statement relative to reservoir project lands which

was issued February 16, 1962, permits increased emphasis to be placed on recreation in the Reclamation program. Implementation of this policy on old projects, however, will require enactment of authorizing legislation. With such authority, additional lands and recreation facilities can be provided to meet increasing recreational needs.

Fish and Wildlife Benefits

Reasonably adequate provisions have been made for utilizing the fish and wildlife resources of Reclamation projects. This has come about through the authority provided by the Fish and Wildlife Coordination Act of 1958 (Public Law 624, 85th Cong., 2d sess., 72 Stat. 503) and other authority. Supplementing the Federal program are the several State programs which take advantage of improved habitats created by Reclamation development to supplement existing fish and wildlife resources.

Weed Control

Control of weeds in irrigation systems is essential to the economic delivery and conservation of water. The Bureau of Reclamation is continuing its comprehensive weed control program which has proved very effective in reducing the problems caused by undesirable vegetation. Operation and maintenance costs caused by weeds have been decreased and the program is aiding materially in reducing water losses resulting from transpiration, evaporation, and seepage.

More efficient and economical methods of controlling weeds infesting banks and channels of irrigation and drainage systems are being developed through the research program conducted in cooperation with the Department of Agriculture. This phase of the program is being accomplished at four field stations in the West, and in the Assistant Commissioner and Chief Engineer's Weed Control Laboratory in Denver.

From a recent survey it was estimated that nearly 2 million acre-feet of water is lost each year because of weeds on irrigation systems in the 17 Western States. It was similarly estimated that the total costs and losses caused by these weeds were about \$5¼ million. The relatively small investment in research and education in weed control has prevented an additional \$15.8 million in costs and losses. While research is being continued, much more effort is seriously needed to aid in solving this major irrigation problem.

Progress was made in developing more effective methods for controlling woody phreatophytes, including salt cedar, where these plants have invaded irrigation systems, natural water courses, reservoirs, and

other areas. These growths not only usurp millions of acre-feet of water so greatly needed for irrigation, municipal, and industrial purposes, but also increase flood hazards and take over lands which should be used for grazing and agriculture. It is estimated that in the 17 Western States all undesirable phreatophytes infest over 15 million acres and transpire at least 25 million acre-feet of water annually. Committees of the Department of Agriculture and the Department of the Interior are working on this and other weed control problems common to Government agencies.

Special studies for developing economically feasible methods for controlling aquatic vegetation in large canals are being conducted in cooperation with the Agricultural Research Service in the Denver Laboratory and on the Columbia Basin project, Washington, and Central Valley project, California.

A halogeton control program has been developed in cooperation with other agencies under the provisions of the Halogeton Glomeratus Act in the interest of increasing the land-use value of the lands under the jurisdiction of the Bureau and of protecting the livestock which graze on these lands. It is known that this poisonous weed infests Bureau lands in Utah, Nevada, Colorado, Wyoming, and Idaho. Surveys to locate halogeton infestations and cooperative investigations to determine the most effective and economical control methods were continued this year. The actual control programs, including chemical spraying and grass seeding, were continued, primarily through agreements with the Bureau of Land Management.

The distribution of motion pictures, slide lectures, manuals, special releases on new equipment, and articles in the Reclamation Era have been continued to advise project personnel on new and more economical methods for controlling weeds.

Soil and Moisture Conservation

The Bureau of Reclamation has continued its program of conserving soil and water on lands under its jurisdiction in keeping with the Department's policy on conservation of natural resources. These operations are directed primarily toward erosion control, reduction of water losses, and the protection of Reclamation-built works.

The program includes planting grasses and trees, building structures, and carrying out other desirable erosion control and soil stabilization practices; controlling undesirable water-consuming vegetation; and placing structures to protect irrigation facilities. Special research is conducted in prevention of water losses caused by evaporation, transpiration, and seepage. The program objectives are accomplished in cooperation with other Federal agencies, as well as State, local and water users' organizations. During fiscal 1962, there were 117 indi-

vidual soil and moisture conservation programs on 64 Federal irrigation projects or units.

Reducing Seepage Losses

Loss of water through seepage in canals is of increasing concern to the Bureau of Reclamation. In addition to lowering the operating efficiency of the canals, high ground water and drainage conditions are compounded by these losses.

Under the Bureau's lower cost canal-lining program, studies were continued to reduce seepage losses from canals and laterals and to prevent the waterlogging of irrigable lands. Particular emphasis was given during the past year to the use of waterborne chemical sealants. There is great need for a lining which does not necessitate taking the water out of the canals. This factor is especially true in the Southwest where canals are utilized throughout the entire year.

Experimental use of chemical sealants was accomplished on the Eden, Columbia Basin, Boise, Klamath, Gila, Belle Fourche and Missouri river basin projects.

The first large-scale installation of a buried plastic membrane lining on a Bureau project was accomplished during March 1962 on the Tucumcari project in New Mexico. Over 1½ miles of the McCaskey and Savage laterals were lined with vinyl plastic.

Use of Water

Increased attention is being given to efficient use of water for irrigation. On most operating projects historical data are not adequate to reach firm conclusions regarding magnitude and extent of wastes and losses. As a result, information needed for planning, design, and efficient operation of projects is often limited.

During the past year, the Bureau has undertaken a more detailed evaluation of the use of water on existing projects. The objectives of this study are (1) to accurately document the present use and disposal of water on existing projects and to determine practical means of increasing efficiency of water use, and (2) to obtain information for improving present procedures or to develop new ones to insure successful and efficient operation of future projects.

Community Development

The town of Page, Ariz., was initially established in connection with the construction of Glen Canyon Dam, a principal feature of the Colorado River storage project. With the initial subdivision completed and utilities available to serve the municipal area, development has advanced rapidly. More than 50 commercial buildings have been

erected, resulting in a reasonably well-balanced complement of businesses from which the approximate 5,000 resident population and thousands of tourists who visit the adjacent dam can obtain basic essentials and a variety of supplemental commodities and services.

Concurrently with the commercial development, construction of residences has shown a gratifying increase because of increased availability of financing for home construction. More than 30 private residential structures were completed, bringing the total number of permanent houses in the town to nearly 200.

Seven churches, an elementary school and a high school, and various municipal and public-use buildings also have been completed.

As construction activities on Glen Canyon Dam and powerplant diminish, it is expected that there will be a compensating increase in tourist and recreational activity which will adequately insure a sound basis for continued municipal growth and development in the town of Page.

Although the community is presently managed and administered by the United States, plans for the future are based on the assumption of functional management and administration of municipal affairs as soon as practical by an appropriately organized corporate entity. As soon as such a transition is practicable, the municipality of Page, Ariz., will be given assistance in assuming a position of self-government comparable to that occupied by other municipalities in the State of Arizona.

Land Settlement

During the fiscal year, the Bureau of Reclamation conducted one land opening. In this opening, 18 full-time farm units on the Columbia Basin project in the State of Washington were made available for purchase by qualified applicants.

This land opening increased to a total of 2,860 the number of farm units, comprising 276,805 irrigable acres, which have been made available for settlement since the close of World War II, either by homesteading or by purchase, on 14 Reclamation projects.

Settlers do not pay for the public land which is opened to homesteading. Government-acquired lands are sold to settlers as farm units. In either case, settlers pay to the Federal Government, through an irrigation district, or other recognized water users' organizations, the pro rata share of the construction costs of irrigation facilities built to supply the land with water. They also pay an annual charge for operation and maintenance of the irrigation works. The construction costs are paid without interest over a long period, usually 40 or 50 years.

Development Farms

The practice of establishing development farms on new irrigation projects has removed many of the factors which caused hardships and often failures of settlers on earlier developed projects. The development farms not only demonstrate more efficient and economical irrigation practices, but also show the value of conserving soil and water through promoting more efficient use of these important natural resources. This phase of conservation is especially important in view of our increasing population and the decreasing areas suitable for agricultural development.



Carrots harvested in the Coachella Valley on Reclamation's All-American Canal system begin trip to market.

Development farms are established as far as possible in advance of settlement, usually 2 to 5 years, in order that much of the necessary experience and information will have been obtained when the new settlers arrive. The farms are located in areas which best represent the soils and other conditions of the new project. The sites are chosen and the plans for the development and operation of each farm are formulated in cooperation with State colleges, Department of Agriculture, and other interested agencies.

The major portion of each farm is devoted to field-scale demonstrations of approved farm irrigation systems, irrigation methods, kinds and varieties of adapted crops, cultural practices, most effective fertilizers, weed control, farm drainage, and solutions to other problems with which new irrigation farmers are faced. From 10 to 25 percent of most of the farms is set aside for research, which is conducted by State college experiment stations and cooperating agricultural agencies such as the Agricultural Research Service and the Soil Conservation Service. Methods developed from research are thoroughly tested and demonstrated on the farms. Some of the farms have served the additional purpose of aiding in determining the feasibility of projects.

The Bureau of Reclamation and other agencies responsible for the development farms work closely with the State college extension services to be certain that the information from research findings and demonstrations is properly disseminated to the new settlers. Hundreds of farmers attend the annual field days and tours at which representatives of the Bureau and the cooperating agencies explain the work in detail. The settlers are encouraged to visit the farms at any time during the year to obtain information. Pamphlets are prepared and distributed which supply data on the crops raised, yields, and other pertinent information. In addition to project farmers the development farms benefit college and high school students who visit the farms with their instructors.

There were 8 development farms in operation during fiscal 1962 and 20 farms previously operated have been discontinued because they have served their purpose. Locations for two additional development farms have been chosen for new units of the Missouri River basin project. Other farms are proposed for new areas scheduled for development.

Cooperation With Other Agencies

The Bureau's activities in planning, developing, and operating Federal irrigation projects and in the conservation of natural resources on lands under its jurisdiction have been greatly facilitated through cooperation with other agencies and organizations. Their special skills, experience, and equipment have been fully utilized whenever it was to the advantage of the Government to do so.

The cooperative work is implemented by means of agreements between the Bureau and the other organizations involved which now include several agencies within the Department of Agriculture and the State colleges and extension services of the 17 contiguous Western States and the State of Alaska, as well as many other Federal, State, and local organizations.

During fiscal 1962 there were about 400 such cooperative agreements in effect. They include studies and investigations conducted on development farms, conservation activities, efficient use of soil and water, crop and cropping problems, assistance to county agricultural agents, and weed control. They cover also the development and management of reservoir, recreational, and wildlife areas, and assistance in solving many other problems pertaining to irrigation projects.

Cooperation with other agencies also includes active participation in numerous departmental, interdepartmental, basin, State, local, and other committees whose functions are related to the Bureau's interests and responsibilities.

Hydroelectric Power Development

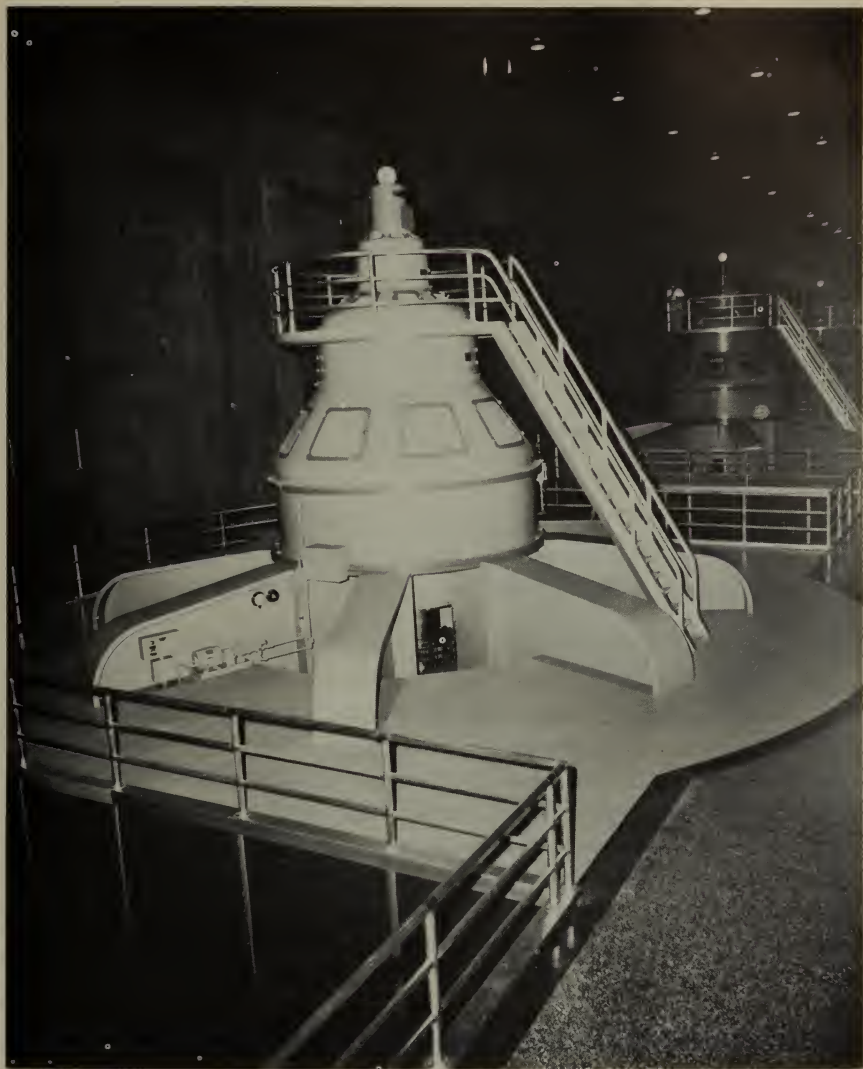
In order to utilize to the greatest advantage the irrigation water supplies made available by multipurpose reservoirs, the Bureau of Reclamation in its program of aiding in the development of America's water resources has constructed and, as of June 30, 1962, is operating 42 powerplants with an installed nameplate capacity of 5,294,550 kilowatts. In addition, the Bureau is responsible for marketing the power generated at five powerplants constructed by the Corps of Engineers with a total installed nameplate capacity of 1,070,035 kilowatts, and one powerplant installed by the International Boundary and Water Commission, with a total nameplate capacity of 31,500 kilowatts.

Sale of electric power by the Bureau during the year aggregated 26,715,730,621 kilowatt-hours, with revenues from sales totaling \$73,637,750, as shown on table 4.

Fiscal Year Expansion

During the fiscal year, the installed nameplate capacity of hydroelectric powerplants at Bureau of Reclamation multipurpose projects and at projects for which the Bureau is responsible for marketing the power was increased 180,000 kilowatts.

Completion of unit N-8 at the Hoover powerplant of the Boulder Canyon project provided 95,000 kilowatts of the increase in installed capacity. This unit, placed in operation December 1, 1961, brought the Hoover powerplant to its planned capacity of 1,344,800 kilowatts. The remaining 85,000 kilowatt increase resulted from the Corps of Engineers putting in service April 9, 1962, the 85,000-kilowatt unit No. 1 at its 595,000-kilowatt Oahe powerplant in South Dakota.



Installation of Hoover powerplant's final generating unit brings the Boulder Canyon project to its full capacity of 1,344,800 kilowatts.

The Corps of Engineers is constructing its 468,000-kilowatt Big Bend powerplant in South Dakota, and initial operation of this powerplant is scheduled for July 1964. The Bureau of Reclamation will be the marketing agent for energy generated by these new plants, as in the case for other plants constructed by the corps on the Missouri River basin project.

Additional Capacity Under Construction

At the end of the fiscal year, the Bureau of Reclamation had under construction 10 powerplants which will have an ultimate installed nameplate capacity of 1,665,850 kilowatts. They are:

Plant	Project	River	State	Nameplate capacity
				<i>Kilowatts</i>
Clear Creek.....	Central Valley.....	Trinity.....	California.....	134,000
Lewiston.....	do.....	do.....	do.....	350
Spring Creek.....	do.....	do.....	do.....	150,000
Trinity.....	do.....	do.....	do.....	100,000
Upper Molina.....	Collbran.....	Cottonwood Creek.....	Colorado.....	8,640
Lower Molina.....	do.....	Plateau Creek.....	do.....	4,860
Blue Mesa.....	Colorado River storage.....	Gunnison.....	do.....	60,000
Flaming Gorge.....	do.....	Green.....	Utah.....	108,000
Glen Canyon.....	do.....	Colorado.....	Arizona.....	900,000
Yellowtail.....	Missouri River basin.....	Big Horn.....	Montana.....	200,000

The hydroelectric powerplants constructed and operated or under construction by the Bureau of Reclamation, and powerplants for which the Bureau is the marketing agent are listed in table 5.

Transmission System

To supply electrical energy for the Bureau's projects and to market the power which is surplus to the Bureau's needs, a transmission system including substations, switchyards, and transmission lines, has been constructed. During the fiscal year, approximately 375 circuit miles of transmission lines were completed, resulting in a total system of 11,082 circuit miles of line. As of June 30, 1962, the installed transformer capacity of the individual substations operated by the Bureau was 11,581,588 kilovolt-amperes. The transmission lines completed in fiscal year 1962 are shown in the following table:

Transmission lines completed during fiscal year 1962

Project and line	Voltage (kilovolts)	In-service date	Circuit miles
Minidoka project:			
Alfresco Junction to East Burley Substation.....	34.5	January 1962.....	2.16
East Burley Substation to Burley Junction.....	34.5	February 1962.....	.23
Missouri River basin project:			
Garrison powerplant to Mallard Substation.....	115.0	December 1961.....	55.06
Mallard Substation to Rugby Substation.....	115.0	do.....	58.43
Jamestown Substation to Fargo Substation No. 2.....	230.0	May 1962.....	84.30
Jamestown Substation to Grand Forks Substation.....	115.0	June 1962.....	110.36
Pine Bluffs, Wyo., to Sidney, Nebr.....	115.0	October 1961.....	164.01
Total.....			374.55

¹ Includes 6.98 miles of line placed in service between Cheyenne and Pine Bluffs, Wyo.

Power Marketing

During fiscal year 1962, there were 119 contracts executed for the sale of power, transmission service, or for other types of electric service. In addition to these contracts, 44 supplemental agreements were executed to implement the supplemental power service program in the eastern division of the Missouri River basin project.

Classes and number of customers included in the 119 contracts are as follows:

Classes of customers:	<i>Number of cus- tomers</i>
Private utilities.....	20
REA cooperatives.....	11
Municipalities.....	63
Federal agencies.....	8
State agencies.....	7
Irrigation districts.....	4
Non-REA cooperatives.....	3
Public utility districts.....	3
Total.....	119

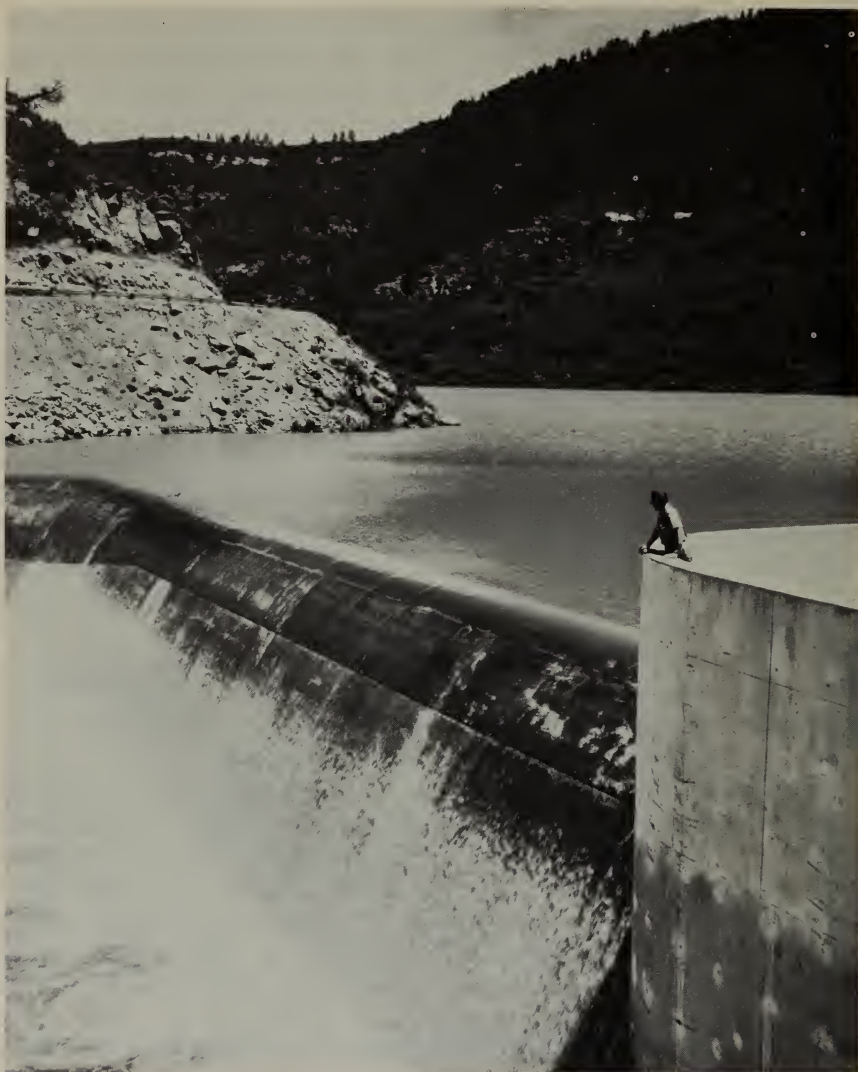
The number of contracts listed above is not representative in each instance of new contracts, since many are renewals of current contracts in order to place the full allocation of power under contract or to incorporate the supplemental power service program.

The Bureau is continuing its policy of contracting for wheeling power and energy beyond delivery points over other existing system facilities through mutual interchange agreements with its customers to augment the supplemental power service program.

Contracts for increased allotments of power to serve load growth through 1965 were executed during fiscal year 1962 to preference customers in the western division of the Missouri River basin. This action was made possible through the withdrawal of power from nonpreference customers on termination of their contracts and from the addition of new capacity within the area.

Contracts were executed with four private utility systems in the Upper Colorado River Basin for providing transmission and exchange power service for the Colorado River storage project developments at the Glen Canyon, Flaming Gorge, Curecanti, and Central Utah project units.

Preference customers within the Upper Colorado River storage project have been invited to submit applications for allotments of CRSP power which is to become available during 1963. The first unit at the Glen Canyon Dam is scheduled for commercial



Paonia Dam, Colo.—the first participating project of Reclamation's Colorado River storage project to be completed and placed in operation.

operation about June 1964. The total capacity of the project power system is about 1,200,000 kilowatts.

Contracts were executed with the Colorado-Ute Electric Association and the Salt River Project Agricultural Improvement & Power Dis-

trict, Arizona. These provide for interconnecting both the Hayden 150,000-kilowatt thermal plant, to be constructed near Craig, Colo., and a planned second plant near Shiprock, N. Mex., with the Colorado River storage project thereby permitting exchange of electric power and energy at various points within the CRSP system on a displacement basis.

Reallocation of power contracts from the Parker-Davis project in three-State southwest area was completed during the year. Of the 194,525 kilowatts available for preference customer consumption, 174,525 kilowatts were committed on a firm basis and the remaining 20,000 kilowatts were allocated subject to recapture by the United States on 2 years' prior notice.

Power from the Trinity River division of the Central Valley project is scheduled to become available starting about February 1, 1963. Preference customers within the Bureau's Region 2 marketing area were invited to submit applications not later than March 1, 1962, respecting their power requirements. The ultimate dependable capacity of the project will be set by a mutual redetermination of project dependable capacity under the terms of the existing contract between the Pacific Gas & Electric Company and the United States.

Financing Reclamation Projects

Appropriations made available to the Bureau of Reclamation for all purposes in fiscal year 1962 totaled \$274,408,100. Permanent appropriations are not included. Appropriations for 1962 were less than those of 1961 by \$7.3 million.

With an unobligated balance of \$33.4 million carried over from fiscal year 1961 for construction, investigations, and the loan program plus funds advanced by water users, trust funds, the continuing fund for emergency expenses of Fort Peck project and new appropriations, the total amount available to Reclamation was \$308 million. Of this amount there remained unobligated at the close of 1962 for use in fiscal year 1963 funds in the amount of \$15.9 million.

Funds appropriated, by activity, for fiscal year 1962, together with the amounts to be derived from the special and general funds are shown in the following condensed statement:

Condensed statement of appropriations, fiscal year 1962 (exclusive of trust funds and permanent appropriations)

General investigations.....		\$6, 643, 000
Reclamation fund.....	\$5, 520, 000	
Colorado River development fund.....	500, 000	
General fund.....	623, 000	
Construction and rehabilitation.....		152, 405, 500
Reclamation fund.....	67, 400, 000	
General fund.....	85, 005, 500	
Operation and maintenance.....		36, 189, 000
Reclamation fund.....	30, 687, 000	
Colorado River Dam fund.....	1, 491, 000	
General fund.....	4, 011, 000	
General administrative expenses.....		9, 430, 000
Reclamation fund.....	9, 430, 000	
Upper Colorado River Basin fund.....		52, 534, 500
General fund.....	52, 534, 500	
Construction of recreational and fish and wildlife facilities.....		2, 933, 500
General fund.....	2, 933, 500	
Loan program.....		13, 272, 600
General fund.....	13, 272, 600	
Emergency fund.....		1, 000, 000
Reclamation fund.....	1, 000, 000	
Grand total.....	274, 408, 100	274, 408, 100
Reclamation fund.....		114, 037, 000
Colorado River development fund.....		500, 000
Colorado River Dam fund.....		1, 491, 000
General fund.....		158, 380, 100
		274, 408, 100

Foreign Activities

Bureau of Reclamation "know-how" in the field of water resources development continued in demand throughout the world during fiscal year 1962.

Revised programing schedules in the Agency for International Development call for completion of the reconnaissance study of the Blue Nile River basin in Ethiopia by the end of fiscal year 1964. Based on this revised schedule, field activities in geology and land classification were completed this year.

The Helmand Valley project in Afghanistan, providing technical assistance and on-the-job training in operation and maintenance of an existing irrigation project, continued to expand. Twenty Bureau technicians were on the rolls or under recruitment at the end of the

fiscal year. In cooperation with the Bureau personnel working in Afghanistan, long-term training programs in the United States, combining academic and in-service training, were arranged for four employees of the Helmand Valley Authority. Similar programs are being arranged for other selected employees of the Authority. The training is designed to prepare the participants for responsible positions with the Authority.

Under the provisions of Public Law 402, the Bureau of Reclamation continued to provide assistance and training to the Snowy Mountains Hydroelectric Authority of Australia, the Royal Irrigation Department of Thailand, and the Central Water and Power Authority of India. Recognizing the increased professional proficiency of its staff, and the ability to provide in-service training for their junior engineers, officials of the Australian Snowy Mountains Hydroelectric Authority notified the Bureau that, with the exception of an occasional specialist, they would no longer send employees to the Bureau for training. This successfully concluded the training program under which the Authority has sent 11 liaison officers, 18 official observers, and 110 trainees to the Bureau during the last 10 years. Technical assistance on design and construction is expected to continue.

During the year, the Bureau arranged training and observation programs ranging from a few days to a year or more in duration for 365 foreign engineers and technicians from 47 countries. Included in this number were the following special groups:

(1) *11-man team of hydroelectric power specialists from the Union of Soviet Socialist Republics.*—Under the terms of the U.S.-U.S.S.R. agreements for exchanges in scientific, technical, and other fields, the Bureau arranged a 4-week program and provided technical escorts for this team. The program included visits to approximately 20 of the major hydroelectric facilities in the country.

(2) *Irrigation and reclamation observation team.*—The Bureau arranged a program in the operation and maintenance of irrigation systems for six officials of irrigation organizations from the Republic of China. A representative of the Bureau acted as technical escort for the team during its 6-week program.

In addition to the project-type assistance and on-the-job training for foreign engineers and technicians at Bureau of Reclamation facilities in the United States, Reclamation personnel were in demand for short-term details to various parts of the world. Details to assist foreign governments involved 17 individuals assigned to 9 countries. Technical problems in design, construction, operation and maintenance, farm settlement, agricultural economics, drainage, and project planning also were frequently referred to the Bureau's Engineering Center in Denver.

Although the major portion of the requests for assistance were received through the Agency for International Development, services were also provided to the United Nations, the International Bank for Reconstruction and Development, the Pan American Union, the Inter-American Development Bank, and, in some instances, directly to the foreign governments.

A number of Reclamation engineers participated in the activities of various international technical societies. The Bureau was represented at the following meetings and conferences:

Annual Meeting of Executive Committee, International Commission on Irrigation and Drainage—Moscow, U.S.S.R.

Latin American Electric Power Seminar, Mexico City.

Ninth Congress, International Association of Hydraulic Research, Dubrovnik, Yugoslavia.

Nineteenth General Assembly, International Conference on Large Electric Systems, Paris, France.

Annual Meeting of Executive Committee, International Congress on Large Dams, Moscow, U.S.S.R.

FAO European Water Management Seminar and Study Tour.

Annual Meeting of Executive Committee, International Commission on Irrigation and Drainage, Jerusalem, Israel.

ECAFE Interregional seminar on Field Methods and Equipment Used in Hydrology and Hydrometeorology, Bangkok, Thailand.

Statistical Summary

- Table 1. Major Bureau of Reclamation contracts Awarded in fiscal year 1962
- Table 2. Principal features completed on Bureau of Reclamation projects in fiscal year 1962
- Table 3. Bureau of Reclamation construction indexes, fiscal year 1962
- Table 4. Power sales and revenues by projects
- Table 5. Hydroelectric powerplants
- Table 6. Classification of power customers
- Table 7. Acreage, production, and gross crop value by crops and types of crops
- Table 8. Irrigation and gross crop value data, by projects, for each State
- Table 9. Accretions to reclamation fund by States, fiscal year 1962
- Table 10. The reclamation fund, funds available for appropriation, fiscal years 1961-62

TABLE 1.—Major Bureau of Reclamation contracts awarded in fiscal year 1962

Feature	Project	Amount of award
Sanford Dam.....	Canadian River.....	\$17,868,160
Blue Mesa Dam and powerplant.....	Colorado River Storage.....	13,706,230
Glen Canyon-Flagstaff-Pinnacle Peak 240-mile, 345-kilovolt transmission line.....	do.....	12,847,830
222 miles of Gas Point Road-Elverta, Elverta-Hedge, and Hedge-Tracy 230-kilovolt transmission lines.....	Central Valley.....	10,611,016
Completion of Glen Canyon powerplant, switchyard, dam, and appurtenant works.....	Colorado River Storage.....	7,891,272
Curecanti-Craig 180-mile, 230-kilovolt transmission line.....	do.....	6,923,100
Cheney Dam.....	Wichita.....	6,661,961
Glen Canyon-Shiprock 182-mile, 230-kilovolt transmission line.....	Colorado River Storage.....	4,854,544
Willard Dam, third stage.....	Weber Basin.....	4,712,470
Cortez-Curecanti 101-mile, 230-kilovolt transmission line.....	Colorado River Storage.....	4,224,514
Causey Dam.....	Weber Basin.....	3,836,419
Norman Dam and 2 miles of State Highway No. 9 relocation.....	Norman.....	3,692,177
Red Bluff diversion dam.....	Central Valley.....	3,465,155
Clark Canyon Dam.....	Missouri River Basin.....	3,347,403
Constructing foundations and furnishing and erecting steel towers for 160-mile Dawson County-Custer Section of Yellow-tail-Dawson County 230-kilovolt transmission line.....	do.....	3,141,958
Willard Canal, pumping plants and intake channel.....	Weber Basin.....	3,138,415
Completion of Trinity, Clear Creek, and Spring Creek powerplants and Clear Creek switchyard.....	Central Valley.....	2,949,108
Barretts diversion dam and 23 miles of East Bench Canal and laterals.....	Missouri River Basin.....	2,420,613
14.1 miles of Ainsworth Canal.....	do.....	2,384,998
13.8 miles of relocation of Chicago, Rock Island, and Pacific Railroad and one-half mile of connections to Chicago, Burlington and Quincy Railroad—Norton Dam.....	do.....	2,381,602
Completion of Flaming Gorge powerplant and switchyard.....	Colorado River Storage.....	1,971,824
20 miles of concrete pipelines and 8 miles of laterals, Madera Distribution System.....	Central Valley.....	1,874,917
19 miles of pipelines and 6 reservoirs, El Dorado Distribution System.....	do.....	1,765,946
Bully Creek Dam and Feeder Canal.....	Vale.....	1,689,901
13 miles of East Bench Canal and 30 miles of East Bench laterals and wasteways.....	Missouri River Basin.....	1,644,854
90 miles of Farwell main laterals and Farwell lower main laterals.....	do.....	1,557,149
Eagle Butte, Martin, Maurine, Mission, and Newell substations.....	do.....	1,356,990
26 miles of Trinity-Clear Creek, Clear Creek-Keswick, and Spring Creek-Keswick 230-kilovolt transmission lines.....	Central Valley.....	1,312,374
13 miles of El Dorado main and laterals.....	do.....	1,181,030
Keswick-Gas Point Road-Cottonwood 22-mile, 230-kilovolt transmission line.....	do.....	1,158,413
7.7 miles of Ainsworth Canal.....	Missouri River Basin.....	1,152,989
37 miles of laterals and wasteways, block 23, Wahluke Branch Canal laterals.....	Columbia Basin.....	1,055,223
Florida Farmers Ditch diversion dam, 3.7 miles of ditch enlargement, and 1.7 miles of Florida Canal enlargement.....	Florida.....	1,042,604
2,240,000 feet of conductor for Glen Canyon-Shiprock 230-kilovolt transmission line.....	Colorado River Storage.....	1,010,240

TABLE 2.—Principal features completed on Bureau of Reclamation projects in fiscal year 1962

Feature	Project	State
Hope Valley and Frenchman Hills pumping plants and discharge lines.	Columbia Basin.....	Washington.
49 miles of laterals and waste ways.	do.....	Do.
Enlargement of 2.1 miles of Potholes Canal.	do.....	Do.
Ochoco Relift and Barnes Butte pumping plants and discharge lines.	Crooked River.....	Oregon.
17 miles of talent lateral rehabilitation.	Rogue River.....	Do.
12 miles of west lateral rehabilitation and 10 miles of west lateral.	do.....	Do.
17 miles of pipelines for El Dorado distribution system.	Central Valley.....	California.
30 miles of pipelines and 10 pumping plants, Stone Corral Irrigation District.	do.....	Do.
20 miles of laterals, 1.5 miles of pipelines for Madera distribution system, part 1 extension.	do.....	Do.
9 miles of laterals, 20 miles of pipelines for Madera distribution system, part 2 extension.	do.....	Do.
11-mile Clear Creek Tunnel.	do.....	Do.
Trinity powerplant structure.	do.....	Do.
6 miles of Trinity County Road and bridge over Trinity River.	do.....	Do.
Clearing of 5,595 acres of Trinity Reservoir.	do.....	Do.
7 miles of laterals, 13 miles of drains for sump 3.	Klamath.....	Do.
9 miles of laterals, 7 miles of drains, leveling 2 miles of existing dikes for sump 2.	do.....	Do.
Generator unit N-8 for Hoover powerplant.	Boulder Canyon.....	Nevada.
Installation of equipment, including turbine for unit N-8, Hoover powerplant.	do.....	Do.
Upper and lower Molina powerplant structures.	Collbran.....	Colorado.
Clearing of 15,600 acres of Navajo Reservoir.	Colorado River Storage.	New Mexico.
Hammond Diversion Dam.	Hammond.....	Do.
Hammond pumping plant, penstock, and discharge line.	do.....	Do.
Paonia Dam.	Paonia.....	Colorado.
Ironstone diversion dam and 530 feet of Ironstone Canal.	Uncompahgre.....	Do.
9 miles of pipeline laterals for Davis aqueduct system.	Weber Basin.....	Utah.
6 miles of Willard Canal, 13 miles of surface drains and irrigation ditches.	do.....	Do.
4 miles of pipeline laterals for West Farmington lateral system.	do.....	Do.
Clearing 8 miles of floodway channel, Albuquerque area unit 1.	Middle Rio Grande.....	New Mexico.
38 miles of pressure pipe, 13 miles of pipe for aqueduct and laterals, Foss aqueduct and Clinton, Bessie, and Cordell laterals.	Washita Basin.....	Oklahoma.
Streets, sidewalks, water and sewer systems for Yellowtail Dam Government camp.	Missouri River Basin.....	Montana.
Nineteen 3-bedroom residences for Yellowtail Government camp.	do.....	Do.
Relocation of 15 miles of railroad at Clark Canyon Reservoir.	do.....	Do.
Foundations and steel towers for 84-mile Jamestown-Fargo 230-kilovolt transmission line No. 2.	do.....	North Dakota.
114-mile Garrison-Minot-Rugby 115-kilovolt transmission line.	do.....	Do.
110-mile Jamestown-Grand Forks 115-kilovolt transmission line.	do.....	Do.
Foundations and steel towers for 136-mile Garrison-Jamestown 230-kilovolt transmission line.	do.....	Do.
Stringing conductor and overhead ground wire for 84-mile Jamestown-Fargo 230-kilovolt-transmission line.	do.....	Do.
Foundations and steel towers for 57-mile Oahe-Fort Thompson 230-kilovolt transmission line.	do.....	South Dakota.
Stringing conductors for second circuit additions for 74-mile Watertown-Granite Falls 230-kilovolt transmission line.	do.....	Do.
16 miles of Culbertson extension canal and 19 miles of laterals.	do.....	Nebraska.
Red Willow Dam.	do.....	Do.
Sherman Dam.	do.....	Do.
7 miles of Cedar Bluff Canal, 1 mile of drains.	do.....	Kansas.
65-mile Cheyenne-Pine Bluffs-Sidney 115-kilovolt transmission line.	do.....	Wyoming.
		Nebraska.

TABLE 3.—*Bureau of Reclamation construction indexes, fiscal year 1962*

[For application to field costs only]

Cost indexes based on January 1940 costs=\$1.00	July 1961	January 1962	June 1962
Dams:			
Earth.....	2.18	2.20	2.20
Dam structure.....	1.86	1.90	1.90
Spillway.....	2.43	2.47	2.47
Outlet works.....	2.73	2.77	2.77
Concrete.....	2.36	2.38	2.38
Diversion.....	2.67	2.69	2.71
Pumping Plants:			
Building and equipment.....	2.93	2.99	3.01
Structures and improvements ¹	2.98	3.00	3.05
Equipment.....	2.99	3.02	3.04
Pumps and prime movers.....	3.06	3.06	3.08
Accessory electric and miscellaneous equipment.....	2.88	2.94	2.96
Steel penstocks and discharge pipes.....	3.88	3.97	3.99
Canals and conduits:			
Canals.....	2.38	2.38	2.40
Canal earthwork.....	1.44	1.44	1.44
Canal structures.....	3.23	3.29	3.34
Conduits (tunnels, free-flow, concrete-lined).....	2.87	2.94	2.94
Laterals and drains.....	3.17	3.24	3.27
Lateral earthwork.....	1.46	1.47	1.47
Lateral structures.....	3.96	4.09	4.14
Powerplants, hydro:			
Building and Equipment.....	2.95	3.01	3.03
Structures and improvements ¹	2.96	3.01	3.06
Equipment.....	2.93	2.98	3.00
Turbines and generators.....	2.93	2.97	2.99
Accessory electric equipment.....	2.72	2.76	2.78
Miscellaneous equipment.....	2.92	2.96	2.96
Concrete pipelines.....	2.49	2.51	2.51
Switchyards and substations.....	2.92	2.96	2.96
Transmission lines:			
Wood-pole 115-kv.....	2.57	2.59	2.59
Poles and fixtures.....	2.46	2.53	2.53
Overhead conductors and devices.....	2.65	2.61	2.61
Steel-tower, 230-kv.....	2.83	2.85	2.85
General property (buildings).....	3.16	3.21	3.21
Roads and bridges:			
Primary roads.....	2.58	2.58	2.58
Secondary roads (unsurfaced).....	2.37	2.38	2.38
Bridges (steel).....	3.25	3.31	3.31
Composite index (indicates general cost trend).....	2.67	2.71	2.71

¹ Indexes for structures and improvements on pumping plants and powerplants are based on a reinforced concrete structure.

TABLE 4.—Bureau of Reclamation power systems, power sales, and revenues by projects, fiscal year ending June 30, 1962

Projects	Sales of electric energy, kilowatt hours ¹	Revenues from sales ¹
Boulder Canyon.....	3,162,525,663	\$8,465,877.99
Central Valley.....	2,915,441,830	11,522,675.00
Columbia Basin ²	12,103,666,360	13,193,115.00
Eklutna.....	169,436,098	1,733,557.70
Falcon.....	110,351,400	395,068.42
Fort Peck.....	39,437,939	165,505.52
Hungry Horse ²	798,615,700	3,840,628.00
Minidoka Units 1 through 6.....	202,776,850	1,062,705.14
Missouri River Basin:		
Eastern Division.....	3,828,393,761	16,071,991.63
Western Division ³	1,592,866,180	10,005,315.60
Palisades, Boise, and Minidoka Unit 7.....	443,625,993	1,543,424.65
Parker-Davis.....	1,105,557,461	4,444,982.00
Provo River.....	11,237,454	34,481.81
Rio Grande.....	61,428,658	348,365.96
Rogue River Basin.....	44,102,000	317,480.40
Weber Basin.....	9,020,900	29,303.00
Yakima ²	106,219,448	430,960.00
Yuma.....	11,026,926	32,312.06
Grand Total.....	26,715,730,621	73,637,749.88

¹ Does not include energy sales and revenues in transactions between Bureau projects² Deliveries to and revenues from Bonneville Power Administration included as follows:

Columbia Basin.....	11,317,435,236	\$12,800,000.00
Hungry Horse.....	795,659,000	3,833,000.00
Yakima.....	75,019,182	345,000.00

Total..... 12,188,113,418 16,978,000.00

³ Includes systems of Riverton, Shoshone, Colorado-Big Thompson, Kendrick's and North Platte projects.

TABLE 5.—*Hydroelectric powerplants*

A. CONSTRUCTED AND OPERATED BY BUREAU OF RECLAMATION

June 30, 1962

State	Project	Name of plant	Calendar year of initial operation	Nameplate rating	
				Existing (kilowatts)	Ultimate (kilowatts)
1. Alaska.....	Eklutna.....	Eklutna.....	1955	30,000	30,000
2. Arizona, Nevada.....	Boulder Canyon.....	Hoover 1.....	1936	1,344,800	1,344,800
3. Arizona-Nevada.....	Parker-Davis.....	Davis.....	1951	225,000	225,000
4. Arizona-California.....	do.....	Parker.....	1942	120,000	120,000
5. California.....	Central Valley.....	Folsom.....	1955	162,000	162,000
6. California.....	do.....	Keswick.....	1949	75,000	75,000
7. California.....	do.....	Nimbus.....	1955	13,500	13,500
8. California.....	do.....	Shasta.....	1944	379,000	379,000
9. California.....	Yuma.....	Siphon Drop.....	1926	1,600	1,600
10. Colorado.....	Colorado-Big Thompson.....	Big Thompson.....	1959	4,500	4,500
11. Colorado.....	do.....	Estes.....	1950	45,000	45,000
12. Colorado.....	do.....	Flatiron.....	1954	71,500	71,500
13. Colorado.....	do.....	Green Mountain.....	1943	21,600	21,600
14. Colorado.....	do.....	Marys Lake.....	1951	8,100	8,100
15. Colorado.....	do.....	Pole Hill.....	1954	33,250	33,250
16. Colorado.....	Grand Valley.....	Grand Valley 2.....	1932	3,000	3,000
17. Idaho.....	Boise.....	Anderson Ranch.....	1950	27,000	40,500
18. Idaho.....	do.....	Black Canyon.....	1925	8,000	8,000
19. Idaho.....	do.....	Boise Diversion.....	1912	1,500	1,500
20. Idaho.....	Minidoka.....	Minidoka.....	1909	13,400	13,400
21. Idaho.....	Palisades.....	Palisades.....	1957	114,000	114,000
22. Montana.....	Missouri River Basin.....	Canyon Ferry.....	1953	50,000	50,000
23. Montana.....	Hungry Horse.....	Hungry Horse.....	1952	285,000	285,000
24. New Mexico.....	Rio Grande.....	Elephant Butte.....	1940	24,300	24,300
25. Oregon.....	Rogue River Basin.....	Green Springs.....	1960	16,000	16,000
26. South Dakota.....	Missouri River Basin.....	Angostura.....	1951	1,200	1,200
27. Utah.....	Provo River.....	Deer Creek.....	1958	4,950	4,950
28. Utah.....	Weber Basin.....	Gateway.....	1958	4,275	4,275
29. Utah.....	do.....	Wanship.....	1958	1,425	1,425
30. Washington.....	Columbia Basin.....	Grand Coulee.....	1941	1,974,000	1,974,000
31. Washington.....	Yakima.....	Chandler.....	1956	12,000	12,000
32. Washington.....	do.....	Roza.....	1958	11,250	11,250
33. Wyoming.....	Missouri River Basin.....	Fremont Canyon.....	1960	48,000	48,000
34. Wyoming.....	Kendrick.....	Alcova.....	1955	36,000	36,000
35. Wyoming.....	do.....	Seminole.....	1939	32,400	32,400
36. Wyoming.....	Missouri River Basin.....	Boysen.....	1952	15,000	15,000
37. Wyoming.....	do.....	Glendo.....	1958	24,000	24,000
38. Wyoming.....	do.....	Kortes.....	1950	36,000	36,000
39. Wyoming.....	North Platte.....	Guernsey.....	1927	4,800	4,800
40. Wyoming.....	Riverton.....	Pilot Butte.....	1925	1,600	1,600
41. Wyoming.....	Shoshone.....	Heart Mountain.....	1948	5,000	5,000
42. Wyoming.....	do.....	Shoshone.....	1922	5,600	5,600
Subtotal A.....	-----	-----	-----	5,294,550	5,308,050

B. CONSTRUCTED AND OPERATED BY OTHERS—POWER MARKETED BY USBR

1. Montana.....	Missouri River Basin (USCE).....	Fort Peck.....	1943	165,000	165,000
2. North Dakota.....	do.....	Garrison.....	1956	400,000	400,000
3. Nebraska-South Dakota.....	do.....	Fort Randall.....	1954	320,000	320,000
4. South Dakota.....	do.....	Gavins Point.....	1956	100,035	100,035
5. South Dakota.....	do.....	Oahe.....	1962	85,000	595,000
6. Texas.....	Falcon (IBWC).....	Falcon.....	1954	31,500	42,000
Subtotal B.....	-----	-----	-----	1,101,535	1,622,035

TABLE 5.—*Hydroelectric powerplants—Continued*

C. UNDER CONSTRUCTION BY BUREAU OF RECLAMATION

June 30, 1962

State	Project	Name of plant	Calendar year of initial operation	Nameplate rating	
				Existing (kilowatts)	Ultimate (kilowatts)
1. Arizona.....	Colorado River Storage...	Glen Canyon.....	1964	0	900,000
2. California.....	Central Valley.....	Clear Creek.....	1963	0	134,000
3. California.....	do.....	Lewiston.....	1962	0	350
4. California.....	do.....	Spring Creek.....	1963	0	150,000
5. California.....	do.....	Trinity.....	1963	0	100,000
6. Colorado.....	Collbran.....	Upper Molina.....	1962	0	8,640
7. Colorado.....	do.....	Lower Molina.....	1962	0	4,860
8. Colorado.....	Colorado River Storage...	Blue Mesa.....	1966	0	60,000
9. Montana.....	Missouri River Basin.....	Yellowtail.....	1966	0	200,000
10. Utah.....	Colorado River Storage...	Flaming Gorge.....	1963	0	108,000
Subtotal C.....					1,665,850

D. UNDER CONSTRUCTION BY OTHERS—POWER TO BE MARKETING BY USBR

1. South Dakota.....	Missouri River Basin (USCE).	Big Bend.....	1964	0	468,000
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¹ Powerplant units operated by Southern California Edison Co. and city of Los Angeles Department of Water and Power as agents of the United States.

² Leased to Public Service Co. of Colorado for operation.

USCE—United States Corps of Engineers.

IBWC—International Boundary and Water Commission.

TABLE 6.—*Summary by classification of customers for 12 months ending June 30, 1962*¹

	Number of customers	Sale of electric energy kilowatt-hours	Revenues from sales
Privately Owned Utilities.....	30	1,563,659,471	5,873,237.80
Municipal Utilities.....	134	2,110,707,925	10,066,304.40
State Government Utilities.....	14	4,186,537,242	15,434,336.24
Cooperative Utilities (Rural Electrification Admin. Projects).....	53	3,235,308,981	16,420,504.03
Other Federal Utilities ²	8	12,245,896,213	17,230,636.45
Residential and Domestic.....	296	6,535,808	32,799.02
Rural (other than Rural Electrification Admin. Projects).....	7	165,600	1,058.11
Commercial and Industrial.....	13	93,114,882	496,291.23
Public Authorities.....	90	2,089,143,893	6,696,625.32
Interdepartmental.....	38	1,184,660,606	1,385,957.28
Total all customers.....	683	26,715,730,621	73,637,749.88

¹ Does not include energy sales and revenues in transactions between Bureau projects

² Totals include 12,188,113,418 kilowatt-hours delivered to Bonneville Power Administration for marketing and \$16,978,000.00 in payment by that agency.

TABLE 7.—*Acreage, production, and gross crop value by crops and types of crops—1961*

Crops	Irrigated lands		Tonnage		Gross crop value	
	Total	Percent of total	Total	Percent of total	Total	Percent of total ¹
Cereals:	<i>Acres</i>	<i>Percent</i>	<i>Tons</i>	<i>Percent</i>	<i>Dollars</i>	<i>Percent</i>
Barley.....	521,702	7.58	724,201	2.099	30,576,513	2.74
Corn.....	307,816	4.47	644,409	1.867	27,594,593	2.48
Oats.....	165,006	2.40	151,344	.439	6,585,960	.59
Rice.....	7,021	.10	14,049	.041	1,222,387	.11
Rye.....	2,928	.04	2,791	.008	117,330	.01
Sorghums (sorgo, kaffir, etc.).....	116,362	1.69	189,301	.549	8,657,847	.78
Wheat.....	388,070	5.63	554,569	1.607	32,480,969	2.91
Other cereals.....	88,227	1.28	132,563	.384	5,812,146	.52
Total Cereals.....	1,597,132	23.19	2,413,227	6.994	113,047,745	10.14
Forage:						
Alfalfa hay.....	1,809,602	27.28	6,990,827	20.260	146,317,409	13.12
Other hay.....	170,950	2.48	319,241	.925	6,175,396	.55
Irrigated pasture.....	985,010	14.31	2,059,267	5.968	33,399,554	3.00
Corn fodder.....	10,714	.16	90,556	.262	720,100	.06
Silage or Ensilage.....	177,656	2.58	2,976,347	8.626	19,934,912	1.79
Crop residue: Beet tops.....			2,456,484	7.119	1,840,315	.17
Stubble, stalks, etc.....			144,559	.419	1,226,949	.11
Straw (all kinds).....			173,768	.504	1,196,600	.11
Root crops (carrots, etc.).....	41		5,445	.016	24,675	
Other forage.....	45,600	.66	44,593	.129	674,636	.06
Total Forage.....	3,199,573	46.47	15,261,087	44.228	211,510,546	18.97
Miscellaneous Field crops:						
Beans, castor.....	1,319	.02	1,094	.003	126,311	.01
Beans, dry and edible.....	356,214	5.17	348,514	1.010	43,300,317	3.88
Broomcorn.....	2,754	.04	21,373	.062	166,760	.02
Cotton, lint (Upland).....	464,723	6.75	227,327	.659	155,623,467	13.96
Cotton, seed (Upland).....			368,717	1.069	20,102,485	1.80
Cotton, lint (American-Egyptian).....	32,601	.47	8,469	.025	9,678,325	.87
Cotton, seed (American-Egyptian).....			14,602	.042	843,539	.08
Hops.....	15,965	.23	12,937	.037	11,243,900	1.01
Peppermint.....	18,998	.28	847	.002	5,246,989	.47
Spearmint.....	11,400	.17	577	.002	3,221,163	.29
Sugar Beets.....	474,441	6.89	8,394,790	24.329	86,847,624	7.79
Other miscellaneous field crops.....	5,424	.08	5,494	.016	580,560	.05
Total Miscellaneous Field Crops.....	1,383,839	20.10	9,404,741	27.256	336,981,440	30.23
Vegetables:						
Asparagus.....	16,067	.23	24,465	.071	5,411,828	.49
Beans (processing).....	13,428	.20	22,640	.066	3,091,214	.28
Beans (fresh market).....	448	.01	1,291	.004	304,617	.03
Broccoli.....	11,263	.16	73,443	.213	6,404,287	.57
Cabbage.....	4,855	.07	54,433	.158	2,749,999	.25
Carrots.....	9,447	.14	128,686	.373	8,240,000	.74
Cauliflower.....	2,287	.03	13,073	.038	1,916,172	.17
Celery.....	1,641	.02	38,869	.113	2,323,613	.21
Corn, sweet (processing).....	28,406	.41	147,163	.426	3,038,223	.27
Corn, sweet (fresh market).....	6,943	.10	25,491	.074	2,553,654	.23
Cucumbers.....	1,928	.03	19,582	.057	2,307,128	.21
Greens (kale, etc.).....	40		26		4,908	
Lettuce.....	68,588	1.00	439,902	1.275	33,044,792	2.96
Melons: Cantaloupes, etc.....	34,544	.50	218,852	.634	20,092,495	1.80
Honey Ball, honeydew, etc.....	4,792	.07	42,925	.124	2,751,893	.25
Watermelons.....	6,810	.10	61,084	.177	2,145,089	.19
Onions, dry.....	16,097	.23	265,380	.769	13,751,397	1.23
Onions, green.....	235		1,929	.006	96,281	.01
Peas, green (processing).....	12,105	.18	20,016	.058	1,614,901	.15
Peas, green (fresh market).....	1,567	.02	3,648	.011	694,926	.06
Peppers (all kinds).....	4,266	.06	12,893	.037	3,374,991	.30
Potatoes, early.....	50,011	.73	669,018	1.939	17,068,318	1.53
Potatoes, late.....	232,934	3.38	2,617,069	7.584	47,690,494	4.28
Squash.....	2,267	.03	20,056	.058	1,540,416	.14
Sweet Potatoes.....	586	.01	2,628	.008	259,928	.02
Tomatoes (canning).....	16,811	.25	274,488	.795	8,067,134	.72
Tomatoes (fresh market).....	6,742	.10	101,917	.295	11,381,508	1.02
Other vegetables.....	6,091	.09	45,959	.133	3,711,626	.33
Total Vegetables.....	561,199	8.15	5,346,926	15.496	205,631,832	18.44

See footnotes at end of table.

TABLE 7.—*Acreage, production, and gross crop value by crops and types of crops—1961—Continued*

Crops	Irrigated lands		Tonnage		Gross crop value	
	Total	Percent of total	Total	Percent of total	Total	Percent of total ¹
	<i>Acres</i>	<i>Percent</i>	<i>Tons</i>	<i>Percent</i>	<i>Dollars</i>	<i>Percent</i>
Total Nursery.....	3,617	0.05			9,260,458	0.83
Seeds:						
Alfalfa.....	75,435	1.10	16,679	.048	10,581,752	.95
Clover (all kinds).....	20,996	.30	4,914	.014	2,837,071	.26
Corn.....	9,283	.13	10,913	.032	1,725,022	.15
Flaxseed.....	11,263	.16	11,375	.033	1,355,455	.12
Grass (all kinds).....	18,265	.27	4,155	.012	2,886,325	.26
Lettuce.....	807	.01	171	-----	179,540	.02
Onion.....	601	.01	130	-----	225,355	.02
Pea.....	37,665	.55	41,286	.120	3,156,108	.28
Potato (all kinds).....	1,042	.01	10,742	.031	660,059	.06
Sugarbeet.....	2,746	.04	4,804	.014	1,440,415	.13
Other seed.....	15,568	.23	9,872	.029	2,009,514	.18
Total Seeds.....	193,671	2.81	115,041	.333	27,056,616	2.43
Fruits:						
Apples.....	47,077	.68	327,535	.949	33,180,594	2.98
Apricots.....	9,690	.14	49,818	.144	3,741,806	.34
Berries (all kinds).....	2,950	.04	9,916	.029	3,477,555	.31
Cherries.....	6,990	.10	18,317	.053	5,875,600	.53
Citrus: Grapefruit.....	16,525	.24	124,963	.362	5,197,935	.47
Lemons and limes.....	13,322	.19	143,076	.415	7,374,540	.66
Oranges and tangerines.....	38,006	.55	208,832	.605	24,832,137	2.23
Dates.....	3,806	.06	15,724	.045	5,149,671	.46
Grapes, table.....	57,377	.83	300,544	.871	27,798,921	2.49
Grapes, other.....	38,755	.56	332,160	.963	15,927,745	1.43
Olives.....	3,570	.13	12,657	.037	2,286,549	.20
Peaches.....	24,315	.36	147,629	.428	10,634,999	.95
Pears.....	26,796	.39	178,516	.517	14,620,197	1.31
Prunes and plums.....	13,147	.19	67,542	.196	7,708,926	.69
Other fruits.....	4,884	.07	14,159	.041	2,150,626	.19
Total Fruits.....	312,210	4.53	1,951,387	5.655	169,957,801	15.24
Nuts:						
Almonds.....	9,231	.13	6,993	.020	3,694,284	.33
Pecans.....	5,219	.08	2,158	.006	1,296,921	.12
Walnuts.....	6,162	.09	4,050	.012	1,804,772	.16
Other nuts.....	7	-----	2	-----	690	-----
Total Nuts.....	20,619	.30	13,203	.038	6,796,667	.61
Family Gardens and Orchards.....	21,664	.31			4,693,662	.42
Total All Crops.....	7,293,524	105.91	34,505,612	100.000	1,084,936,767	97.31
Less Multiple Cropped.....	579,388	8.41				
Total Harvested Cropland and Pasture.....	6,714,136	97.50				
Cropland Not Harvested.....	131,277	1.91				
Soil building.....	40,571	.59				
Acres Irrigated.....	6,885,984	100.00				
Additional Revenues ²					29,939,694	2.69
Total Gross Crop Value.....					1,114,876,461	100.00
Full Irrigation Service.....	3,498,449	50.81			567,005,736	50.86
Supplemental Irrigation Service.....	3,339,271	48.49			539,513,698	48.39
Temporary Irrigation Service.....	48,264	.70			8,357,027	.75

¹ Additional revenues are included in computing percentages.² Includes payments received from Federal and commercial agencies.

TABLE 8.—Irrigation and gross crop value data, by projects, for each State, 1961

State and project	Irrigable area for service				Irrigated area	Gross crop value	
	Full	Supplemental	Temporary	Total		Amount	Per irrigated acre
	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Acres</i>	<i>Dollars</i>	<i>Dollars</i>
Arizona:							
Gila	103,449			103,449	76,863	15,887,107	206.69
Salt River	238,213			333,943	227,038	68,154,338	300.19
Yuma (see also California)	51,936	95,730		51,936	45,149	25,798,698	571.41
Yuma Auxiliary	3,406			3,406	3,077	1,043,038	338.98
Total—Arizona	397,004	95,730		492,734	352,127	110,883,181	314.90
California:							
Boulder Canyon	608,530			608,530	490,406	135,725,557	276.76
Cachuma	500			27,110	10,578	8,082,582	764.09
Central Valley	35,707	26,610		890,810	744,672	206,450,478	277.24
Klamath (see also Oregon)	80,632	822,928	32,175	80,632	78,013	9,393,379	120.41
Oroville	19,811			19,811	17,211	1,552,728	90.22
Santa Maria		35,200		35,200	30,651	30,527,571	995.97
Solano		39,744		39,744	31,011	8,195,387	264.27
Ventura River	672	3,797		4,469	2,280	2,064,092	905.31
Yuma (see also Arizona)	14,620			14,620	10,960	2,457,511	224.23
Total—California	760,472	928,279	32,175	1,720,926	1,415,782	404,449,285	285.67
Colorado:							
Colorado-Big Thompson		720,000		720,000	720,000	78,166,238	108.56
Fruitgrowers Dam		2,662		2,662	1,772	252,351	142.41
Grand Valley	34,686	7,995		42,681	35,049	6,647,440	189.66
Manitou		8,650		8,650	7,434	351,880	47.33
Poudre		13,070		13,070	8,991	2,085,849	226.43
Pine River (see also New Mexico)		40,111		40,111	34,871	1,325,213	38.00
Pine River Indian Irrigation		13,000		13,000	9,932	429,138	43.21
Uncompagre	76,447			76,447	63,372	5,425,402	85.61
Total—Colorado	111,133	805,488		916,621	881,421	94,633,511	107.36
Idaho:							
Avondale	873			873	513	26,842	52.32
Boise (see also Oregon)	223,065			359,180	321,342	43,452,087	135.22
Delta Gardens	944	136,115		944	692	40,588	71.66
Lewiston Orchards	3,595			3,595	1,932	584,939	302.76
Little Wood River		9,549		9,549	6,697	337,159	55.30
Michaud Flats	9,720			9,720	9,017	1,286,042	142.62
Minidoka	214,642			1,160,356	1,078,224	109,750,578	101.79
Owyhee (see also Oregon)	33,360	945,554	360	33,360	1,31,274	4,764,704	152.36
Preston Bench		4,500		4,500	4,165	350,218	84.09

Rathdrum Prairie.....	5, 010	---	---	---	5, 010	3, 860	386, 203	100. 05
Total—I Idaho.....	491, 209	1, 095, 518	360	---	1, 587, 087	1, 457, 119	160, 988, 450	110. 48
Kansas:								
Missouri River Basin:								
Bostwick Division:	36, 413	---	---	---	36, 413	21, 962	1, 313, 308	59. 80
Kansas Bostwick I. D. (see also Nebraska):	11, 500	---	---	---	11, 500	7, 551	702, 229	93. 00
Kirwin Unit.....	8, 500	---	---	---	8, 500	2, 912	302, 049	103. 73
Webster Unit.....	---	---	---	---	---	---	---	---
Total—Kansas.....	56, 413	---	---	---	56, 413	32, 425	2, 317, 586	71. 48
Montana:								
Bitter Root.....	16, 685	---	---	---	16, 685	16, 002	727, 984	45. 49
Buffalo Rapids.....	22, 988	---	---	---	22, 988	21, 264	1, 817, 441	85. 47
Frenchtown.....	3, 810	---	---	---	3, 810	3, 975	238, 375	59. 96
Hunkley.....	32, 447	---	---	---	32, 447	24, 244	1, 757, 150	72. 48
Inlake.....	881	---	---	---	881	806	46, 116	57. 22
Inlake Yellowstone (see also North Dakota):	34, 554	---	---	---	34, 554	29, 862	3, 007, 713	100. 72
Lewistown.....	118, 391	---	---	---	118, 391	87, 580	3, 970, 084	45. 33
Missoula Valley.....	118, 391	---	---	---	118, 391	668	28, 761	43. 06
North River Basin:								
Fedora Valley Unit.....	14, 121	---	---	---	14, 121	8, 839	401, 739	45. 45
Grow Creek Pump Unit.....	4, 545	---	---	---	4, 545	3, 432	302, 405	87. 60
Sage Unit.....	2, 215	---	---	---	2, 215	1, 997	117, 178	58. 68
Sun River.....	91, 797	---	---	---	91, 797	68, 069	3, 069, 829	44. 22
Total—Montana.....	344, 341	---	---	---	344, 341	266, 768	15, 424, 775	57. 82
Nebraska:								
Mirage Plats.....	11, 662	---	---	---	11, 662	10, 972	1, 177, 882	107. 35
Missouri River Basin:								
Bostwick Division:								
Nebraska Bostwick I. D. (see also Kansas):	22, 755	---	---	---	22, 755	16, 906	1, 430, 531	84. 62
Frenchman-Cambridge Division:								
Frenchman Valley I. D.....	38, 640	---	---	---	38, 640	31, 818	3, 009, 844	94. 60
H & R W Irrigation District.....	4, 355	---	---	---	4, 355	8, 109	558, 562	68. 88
Glenda Unit (see also Wyoming):	22, 524	---	---	---	22, 524	17, 684	2, 373, 852	134. 35
Sargent Unit.....	12, 900	---	---	---	12, 900	7, 936	793, 873	76. 13
North Platte (see also Wyoming):	171, 964	---	---	---	264, 362	242, 968	28, 753, 990	118. 34
Total—Nebraska.....	262, 276	124, 522	---	---	386, 798	339, 930	38, 140, 582	112. 20
Nevada:								
Humboldt.....	---	39, 623	---	---	39, 623	16, 443	1, 139, 332	69. 29
Newlands.....	72, 054	---	---	---	72, 054	50, 417	2, 989, 470	59. 29
Truckee Storage.....	---	28, 755	---	---	28, 755	20, 010	1, 031, 552	51. 55
Total—Nevada.....	72, 054	68, 378	---	---	140, 432	86, 870	5, 160, 354	59. 40

See footnotes at end of table.

TABLE 8.—Irrigation and gross crop value data, by projects, for each State, 1961—Continued

State and project	Irrigable area for service				Irrigated area	Gross crop value	
	Full	Supplemental	Temporary	Total		Amount	Per irrigated acre
	Acres	Acres	Acres	Acres	Acres	Dollars	Dollars
New Mexico:							
Carlisle	25,055			25,055	20,970	5,054,636	241.04
Fort Selden	6,500			6,500		388,902	71.46
Madrid	121,680			121,680	53,147	4,422,370	83.21
Mimbres Rio Grande						18,950	30.32
Pine River (see also Colorado)	102,082		1,030	103,112	85,388	23,635,842	276.80
Rio Grande (see also Texas)	41,397			41,397	34,398	1,739,550	50.57
Tucuman	7,379			7,379	6,436	128,292	20.09
Vermejo							
Total—New Mexico	304,093		1,030	305,123	206,406	35,399,532	171.46
North Dakota:							
Butte-Trenton	7,655			7,655	7,079	700,407	98.94
Lower Yellowstone (see also Montana)	17,696			17,696	16,179	1,469,447	90.82
Missouri River Basin	400			400	293	37,572	128.23
Dickinson Unit	2,463			2,463	1,906	127,984	67.15
Heart Butte Unit	2,039			2,039	1,299	78,031	60.07
Fort Clark Unit							
Total—North Dakota	30,253			30,253	26,756	2,413,441	90.20
Oklahoma:							
W. C. Austin	47,809			47,809	42,001	7,161,300	170.50
Total—Oklahoma	47,809			47,809	42,001	7,161,300	170.50
Oregon:							
Arnold	4,292			4,292	3,087	118,471	38.38
Baker		7,281		7,281	7,280	373,448	51.44
Boise (see also Idaho)	1,696			1,696	1,278	97,347	76.17
Burns River		15,616		15,616	15,486	815,449	52.66
Crescent Lake Dam	6,650			6,650	6,081	371,244	61.04
Crooked River	8,500			8,500	8,193	648,280	79.12
Deschutes	50,000			50,000	91,750	9,146,704	99.69
Granias Pass	10,370			10,370	7,144	673,503	94.28
Klamath (see also California)	135,474		1,172	136,646	121,160	12,236,464	100.99
Owyhee (see also Idaho)	71,656			71,656	78,997	14,582,866	184.60
Rogue River Basin		13,000		13,000	8,656	5,920,912	284.06
Umatilla	17,859			17,859	23,801	2,255,741	90.26
Vale	32,000		513	32,513	31,387	2,073,632	69.74
Wapinitia		2,108		2,108	1,686	123,473	73.23
Total—Oregon	338,497	123,811	1,685	463,993	417,690	49,437,534	118.36

South Dakota:	57, 183	---	57, 183	52, 728	1, 877, 398	35. 61
Belle Fourche.....	12, 135	---	12, 135	8, 821	336, 672	38. 17
Missouri River Basin:	8, 900	---	8, 900	5, 318	217, 215	40. 55
Angostura Unit.....	---	---	---	---	---	---
Rapid Valley.....	69, 318	---	69, 318	66, 867	2, 431, 285	36. 36
Total—South Dakota.....	---	---	---	---	---	---
Texas:	---	---	---	---	---	---
Balmorhea.....	10, 608	---	10, 608	7, 163	823, 750	115. 00
Rio Grande (see also New Mexico).....	1 18, 342	---	2 94, 456	65, 927	19, 907, 847	301. 97
Total—Texas.....	---	---	2 28, 950	73, 090	20, 731, 606	283. 64
Utah:	---	---	---	---	---	---
Hyrum.....	6, 800	---	6, 800	6, 209	388, 420	62. 56
Moon Lake.....	75, 256	---	75, 256	42, 167	892, 301	21. 16
Newton.....	2, 600	---	2, 600	2, 108	94, 390	44. 78
Ogden River.....	23, 447	---	23, 447	15, 598	1, 971, 718	136. 41
Provo River.....	48, 156	---	48, 156	37, 398	3, 092, 757	52. 70
Sanpete.....	13, 694	---	13, 694	8, 618	4, 471, 202	48. 06
Scofield.....	15, 843	---	15, 843	8, 618	388, 350	77. 32
Strawberry Valley.....	27, 302	---	44, 571	38, 692	2, 991, 554	111. 78
Weber River.....	17, 269	---	108, 978	90, 556	10, 122, 483	80. 62
Total—Utah.....	---	---	322, 076	253, 190	20, 413, 175	---
Washington:	---	---	---	---	---	---
Chief Joseph Dam.....	2, 860	---	2, 860	1, 423	195, 067	137. 08
Columbia Basin.....	442, 422	---	442, 422	314, 239	41, 663, 398	132. 58
Okanogan.....	5, 038	---	5, 038	4, 181	809, 896	193. 70
Yakima.....	279, 922	---	461, 922	381, 120	84, 329, 899	221. 27
Total—Washington.....	---	---	156	700, 963	126, 998, 260	181. 18
Wyoming:	---	---	---	---	---	---
Eden.....	17, 022	---	17, 022	11, 951	300, 425	25. 14
Kendrick.....	23, 957	---	23, 957	20, 790	1, 133, 614	54. 53
Missouri River Basin:	---	---	---	---	---	---
Boysen Unit.....	8, 732	---	19, 905	17, 915	1, 346, 349	75. 15
Glendo Unit (see also Nebraska).....	---	---	---	8, 732	622, 364	107. 51
Hanover-Bluff Unit.....	6, 527	---	6, 527	6, 176	582, 754	94. 36
Owl Creek Unit.....	11, 338	---	11, 338	8, 995	428, 270	47. 61
North Platte (see also Nebraska).....	54, 359	---	70, 676	68, 028	6, 370, 077	93. 64
Riverton.....	55, 545	---	55, 545	49, 505	2, 460, 350	49. 70
Shoshone.....	93, 580	---	93, 580	77, 430	4, 658, 401	60. 16
Total—Wyoming.....	---	---	36, 387	266, 579	17, 902, 604	67. 16
Total—All States.....	---	---	3, 819, 883	6, 885, 984	1, 114, 876, 461	161. 91

1 Area for which service is available under Warren Act contract.

2 Includes 18,342 acres for which service is available under Warren Act contract.

TABLE 9.—*Accretions to reclamation fund by States, fiscal year 1962*

State	Sale of public lands and timber		Proceeds from Mineral Leasing Act		Total to June 30, 1962
	Fiscal year 1962	To June 30, 1962	Fiscal year 1962	To June 30, 1962	
Alabama.....			\$1, 223. 13	\$218, 792. 10	\$218, 792. 10
Arizona.....	\$400, 933. 21	\$6, 820, 921. 57	275, 210. 89	1, 894, 515. 59	8, 715, 437. 16
Arkansas.....			79, 433. 58	231, 711. 71	231, 711. 71
California.....	1, 798, 208. 71	19, 445, 003. 89	3, 541, 574. 03	89, 059, 606. 99	108, 504, 610. 88
Colorado.....	288, 817. 73	13, 137, 822. 34	4, 595, 869. 46	61, 502, 997. 94	74, 640, 820. 28
Florida.....			168. 65	3, 656. 09	3, 656. 09
Idaho.....	403, 250. 46	10, 291, 475. 56	141, 685. 86	1, 998, 278. 99	12, 289, 754. 55
Illinois.....				74. 81	74. 81
Indiana.....				84. 00	84. 00
Kansas.....		1, 046, 576. 99	211, 279. 31	1, 174, 236. 92	2, 220, 813. 91
Louisiana.....			165, 511. 60	1, 671, 060. 02	1, 671, 060. 02
Michigan.....			8, 044. 16	43, 385. 37	43, 385. 37
Mississippi.....			3, 944. 80	37, 297. 52	37, 297. 52
Montana.....	160, 028. 70	17, 255, 847. 20	2, 459, 798. 61	24, 335, 310. 44	41, 591, 157. 64
Nebraska.....		2, 223, 294. 97	15, 935. 43	115, 292. 36	2, 338, 587. 33
Nevada.....	1, 165, 540. 92	5, 445, 613. 39	276, 540. 94	4, 581, 512. 49	10, 027, 125. 88
New Mexico.....	333, 227. 38	8, 576, 118. 33	11, 742, 097. 73	83, 846, 977. 32	92, 423, 095. 65
North Dakota.....	537. 60	12, 302, 429. 78	139, 286. 46	1, 527, 537. 50	13, 829, 967. 28
Oklahoma.....	5, 733. 60	6, 087, 689. 57	111, 404. 60	519, 334. 93	6, 607, 024. 50
Oregon.....	1, 082, 763. 94	21, 308, 023. 56	8, 644. 38	437, 849. 94	21, 745, 873. 50
South Dakota.....	(285. 90)	7, 898, 205. 83	71, 788. 21	1, 242, 803. 21	9, 141, 009. 04
Utah.....	45, 568. 01	5, 347, 239. 59	4, 058, 688. 79	31, 675, 368. 70	37, 022, 608. 29
Washington.....	165, 118. 37	10, 333, 068. 78	3, 718. 84	101, 294. 37	10, 434, 363. 15
Wyoming.....	78, 489. 34	10, 050, 723. 09	18, 806, 865. 66	213, 294, 680. 71	223, 345, 403. 80
Total.....	5, 927, 932. 07	157, 570, 054. 44	46, 718, 715. 12	519, 513, 660. 02	677, 083, 714. 46

Other accretions		Fiscal year 1962	Total to June 30, 1962
Proceeds, Federal water power licenses.....		\$77, 937. 91	\$1, 884, 767. 09
Proceeds, potassium royalties and rentals.....		1, 642, 779. 88	25, 012, 124. 11
Receipts from naval petroleum reserves, 1920-1938, act of May 9, 1938.....			29, 778, 300. 23
Proceeds from rights-of-way over withdrawn lands, act of July 19, 1919.....		1, 442. 40	17, 270. 09
Miscellaneous mineral leasing permits.....		460. 00	1, 077. 25
Miscellaneous items, other.....			5. 78
Total.....		1, 722, 620. 19	56, 693, 544. 55
Grand total.....		54, 369, 267. 38	733, 777, 259. 01

TABLE 10.—*The reclamation fund, funds available for appropriation, fiscal years 1961-1962*

Receipts and appropriations	Actual 1961	Actual 1962
Unappropriated balance brought forward (as of June 30)	\$119,663,735	\$117,711,983
Collections:		
Bureau of Reclamation:		
Power revenues	49,302,725	49,860,951
All other	20,034,338	18,750,246
Other agencies	51,491,613	54,369,268
Total collections	120,828,676	122,980,465
Expired and lapsed appropriations	2,048,572	3,767,017
Total available for appropriation	242,540,983	244,459,465
Annual appropriations:		
General Investigations	3,943,000	5,520,000
Construction and Rehabilitation	90,000,000	67,400,000
Operation and Maintenance	26,496,000	30,687,000
General Administrative Expenses	4,290,000	9,430,000
Emergency Fund		1,000,000
Total annual appropriations	124,729,000	114,037,000
Permanently authorized appropriations:		
Refunds and Returns	92,000	
Farmers Irrigation District, North Platte Project	8,000	8,000
Total appropriations	124,829,000	114,045,000
Unappropriated balance carried forward	117,711,983	130,414,465

Bonneville Power Administration

Charles F. Luce, *Administrator*



President Franklin Delano Roosevelt on August 20, 1937, signed the Bonneville Project Act, marking the birth of Bonneville Power Administration. With a stroke of his pen, he heralded an unparalleled quarter century of Pacific Northwest hydroelectric and economic growth.

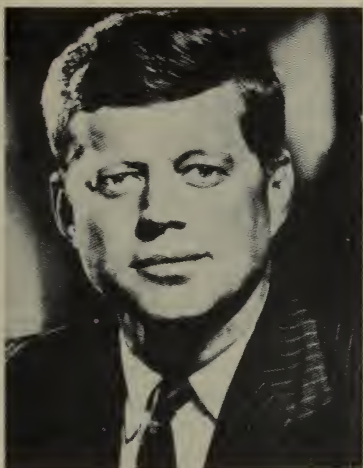
Today, no other single river basin in the world surpasses the hydroelectric development of the Columbia River power system. Bonneville Power Administration's utility operations, serve an area of 220,000 square miles covering Oregon, Washington, Northern Idaho, Western Montana and a small corner of Nevada, with a rapidly growing population already in excess of 5,000,000 people.

Bonneville Power Administration delivered the first generation from Bonneville Dam to the City of Cascade Locks, Oregon, on July 9, 1938. Since that time, BPA has been designated the marketing agency for 20 Federal multipurpose projects in the Columbia River Basin, including 16 Corps of Engineers and 4 Bureau of Reclamation projects.

Public Benefits

Power revenues will repay about 80 percent of the total investment in the Columbia River system of multipurpose dams in addition to substantial irrigation assistance and all operating costs. The inclusion of power facilities makes possible the tremendous public benefits that come from flood control, navigation, recreation, and irrigation. Multipurpose development is made feasible by the inclusion

Letter From President Kennedy on the 25th Anniversary of Bonneville Power Administration.



August 20, 1962

When you help build a region, you help build your nation. This is the real significance of Bonneville Power Administration's first 25 years.

The Bonneville Project Act, signed 25 years ago by President Franklin D. Roosevelt, expressed the aspirations of the Pacific Northwest with respect to its unique endowment of water resources. It foresaw what wide distribution of electric power at low cost could do for the region and the nation, and it provided the vehicle to accomplish this goal.

Today the evidence is all around us. People of the Pacific Northwest use more electricity--for their homes, their farms, their businesses, their industries--than the residents of any other region. More than 99 percent of the area's farms are electrified. Northwest industry has built and thrived and expanded on Columbia River power. Electric rates of all utilities, public and private, in the Bonneville marketing area are some of the lowest in the nation.

Other regions also have benefited. The economic growth of the Pacific Northwest has created a bigger market for Detroit cars and Pittsburgh steel and Boston shoes and Atlanta textiles. The list is almost without end, and proves again that the economic vitality of one region affects the economic vitality of all other regions.

Twice in Bonneville's relatively short life-span our nation has been required to fight wars to preserve freedom. On each occasion, Bonneville's great hydro and transmission resources played an important role in victory.

Bonneville's first 25 years point the way to ever bigger contributions to the economic growth and prosperity and security of our nation.

The job of developing the hydroelectric potential of the Columbia River system is less than half done. May the past achievements of the Bonneville Power Administration serve as an inspiration to get on with the job in the years ahead.

of power which carries a large share of the costs of the dams and reservoirs.

Generation Added

Ice Harbor Dam on the Snake with 270,000 kilowatts of installed capacity, and Hills Creek Dam on the Middle Fork of the Willamette, with 30,000 kilowatts, were completed during fiscal year 1962. This brought the nameplate rating of the Columbia River power system to 6,489,250 kilowatts. Projects under construction will increase the nameplate rating to 8,379,250, and construction of three authorized projects would bring the total to 9,533,250.

Federal reservoir storage usable for power, was increased to 10,456,000 acre-feet with addition of the 249,000 acre-feet at Hills Creek. Cougar and Green Peter, now under construction in the Willamette Basin, will add 487,000 acre-feet. Libby, an authorized project, would provide 5,010,000 acre-feet but construction is conditional on final ratification of the Canadian Treaty.

Projects existing, under construction and authorized are shown in table I.

Non-Federal Generation

Non-Federal generation in the area served by Bonneville Power Administration increased by addition of 772,300 kilowatts of installed capacity during fiscal year 1962, bringing the total non-Federal capacity to 5,127,850 kilowatts.

Future additions under construction or licensed would add about 3,054,000 kilowatts.

Northwest Power Pool

During fiscal year 1962 Bonneville Power Administration supplied 52.6 percent of the total energy generated by the major utilities of the region and 48.5 percent of the net requirements of the Northwest Power Pool. Generation by principal electric utility systems of the region is shown in the Northwest Power Pool chart.

Third of a Trillion

Bonneville Power Administration since beginning of operations in 1938 has sold over a third of a trillion kilowatt hours of hydroelectric energy. This would be enough to meet the current power requirements of the City of Seattle for 95 years or of the entire United States for 8 months.

Increasing by 2.2 percent over the previous year, fiscal year 1962 power sales totaled 29.2 billion kilowatt hours for \$68,900,000, an average of 2.36 mills per kilowatt hour.

TABLE I.—U.S. Columbia River Power System—General specifications, projects existing, under construction and authorized June 30, 1962

Project	Operating agency ¹	Location	Stream	Plant installations		Date in service (initial unit)	Generation fiscal year 1962 ³
				Number of units	Total capacity kilowatts ²		
Existing:							
Bonneville	CE	Washington-Oregon	Columbia	10	518, 400	June 1938	3, 461
Grand Coulee	BR	Washington	do	18	1, 944, 000	September 1941	11, 433
Hungry Horse	BR	Montana	South Fork Flathead	4	285, 000	October 1952	796
McKort	CE	Oregon	North Santiam	2	100, 000	July 1953	388
Big Cliff	CE	Washington-Oregon	Columbia	14	980, 000	November 1953	4, 869
Lookout Point	CE	Oregon	North Santiam	1	18, 000	June 1954	273
Alouk Falls	CE	Idaho	Middle Fork Willamette	3	120, 000	December 1954	178
Dixie	CE	Oregon	Pend Oreille	3	42, 600	March 1955	58
Chief Joseph	CE	Washington	Middle Fork Willamette	1	15, 000	May 1955	4, 446
Gladwin	BR	do	Columbia	16	1, 024, 000	August 1955	40
The Dalles	CE	Washington-Oregon	Columbia	16	1, 119, 000	February 1956	4, 985
Reza	BR	Washington	Yakima	1	11, 250	May 1957	50
Ice Harbor	CE	do	Snake	3	270, 000	August 1958	537
Hills Creek	CE	Oregon	Middle Fork Willamette	2	30, 000	December 1961	11
Subtotal					6, 489, 250		31, 510
Under construction:							
Cougar	CE	Oregon	South Fork McKenzie	2	25, 000	November 1963	
Green Peter	CE	do	Middle Santiam	2	80, 000	April 1966	
Foster	CE	do	South Santiam	2	30, 000	April 1966	
John Day	CE	Washington-Oregon	Columbia	10	1, 350, 000	June 1967	
Lower Monumental	CE	Washington	Snake	3	405, 000	December 1967	
Subtotal					1, 890, 000		
Authorized:							
Libby	CE	Montana	Kootenai	4	344, 000		
Little Goose	CE	Washington	Snake	3	405, 000		
Lower Granite	CE	do	do	3	405, 000		
Subtotal					1, 154, 000		
Total, 23 projects					9, 533, 250		

¹ CE—Corps of Engineers; BR—Bureau of Reclamation.

² Nameplate rating.

³ Millions of kilowatt-hours.

TABLE II.—*Electric energy account for fiscal year 1962*

Energy received (millions of kilowatt-hours):

Energy generated for BPA:

Bureau of Reclamation----- 12, 318

Corps of Engineers----- 19, 192

Power interchanged in----- 12, 320

Total received----- 43, 830

Energy delivered (millions of kilowatt-hours):

Sales----- 29, 157

Power interchanged out----- 12, 649

Used by Administration----- 37

Total delivered----- 41, 843

Energy losses in transmission and transformation----- 1, 987

Losses in percent of total received—percent----- 4. 5

Maximum demand on Federal plants (kilowatts) February 27, 1962,
9-10 a.m., PST----- 4, 967, 000

Load factor, total generated for BPA, percent----- 72. 4

Percentage distribution by classes of customers for fiscal year 1962
follow:

	<i>Number of customers, June 1962</i>	<i>Energy sale by percent of total</i>
Publicly owned utilities-----	82	43. 4
Privately owned utilities-----	8	10. 8
Aluminum industry-----	9	30. 1
Other industries and Federal agencies-----	20	15. 7
Total-----	119	100. 0

Trend of Sales

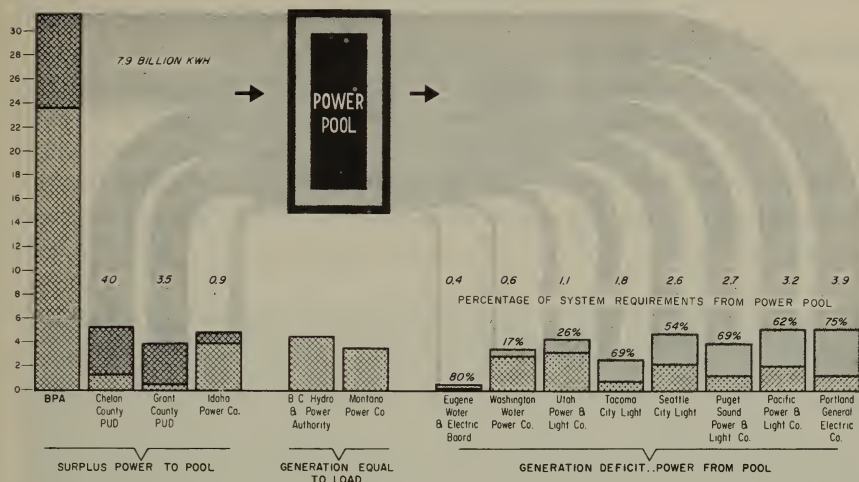
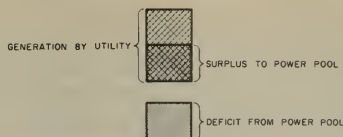
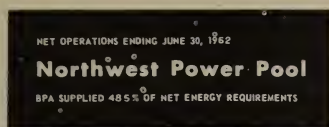
Sales to publicly owned utilities continued to increase at a higher rate than other classes of customers, for an average of 16.4 percent a year or 164 percent during the last 10-year period.

Total energy sales during the same 10-year period increased 71 percent, private utility sales decreased 17 percent, sales to aluminum companies increased 35 percent and combined sales to Federal agencies and other industries, increased 135 percent.

Comparative energy sales by classes of customers for 1961 and 1962 are shown in table III. Growth of sales since beginning of operations are graphically illustrated in the chart entitled Sales of Electric Energy by Classes of Customers.

Basic Power Rate Holds

Bonneville Power Administration's famed "Postage Stamp" rate of \$17.50 per kilowatt year has been in effect since beginning of



operations nearly a quarter century ago. The current rate will continue until at least December 20, 1964, date of the next 5-year rate review and adjustment period specified in the Bonneville Act.

TABLE III.—Sales of electric energy by classes of customers

	Fiscal year 1962		Fiscal year 1961		Percent increase
	Millions of kilowatt-hours	Mills per kilowatt-hour	Millions of kilowatt-hours	Mills per kilowatt-hour	
Publicly owned utilities:					
Firm.....	12,131	2.69	10,876	2.72	11.5
Nonfirm.....	536	2.50	198	2.50	170.7
Total.....	12,667	2.68	11,074	2.71	14.4
Privately owned utilities:					
Firm.....	2,607	2.13	3,629	2.24	-28.2
Nonfirm.....	554	2.50	673	2.50	-17.7
Total.....	3,161	2.19	4,302	2.28	-26.5
Aluminum plants:					
Firm.....	7,046	2.03	7,431	2.01	-5.2
Nonfirm.....	1,719	1.78	1,128	1.76	52.4
Total.....	8,765	1.98	8,559	1.98	2.4
Other industries: ¹					
Firm.....	4,074	2.31	4,193	2.24	-2.8
Nonfirm.....	490	2.22	393	2.26	24.7
Total.....	4,564	2.30	4,586	2.26	-0.5
Total energy:					
Firm.....	25,858	2.39	26,129	2.37	-1.0
Nonfirm.....	3,299	2.09	2,392	2.11	37.9
Total.....	29,157	2.36	28,521	2.35	2.2

¹ Includes Federal agencies.

BPA delivered about 64 percent of its energy sales—at an average cost of 2.18 mills per kilowatt-hour—to industries and to utilities having substantial generating facilities. A summary of energy sales for the fiscal year, classified by rate schedules, appears in table IV.

Industrial Use

Bonneville's industrial customers have, in the aggregate, an estimated capacity to use power at the rate of approximately 1,900,000 kilowatts per year. As of June 30, 1962, their power purchases from the Government and from other sources totaled 1,499,000 kilowatts, leaving idle plant capacity of about 401,000 kilowatts. Firm deliveries from the Government directly to industrial customers were 999,000 kilowatts, interruptible deliveries were 282,000 kilowatts. These industries purchased the remaining 218,000 kilowatts from non-Federal sources.

Low Cost Power

The Pacific Northwest, largely due to abundant low cost power from the Federal system, has a residential and farm use $2\frac{1}{2}$ times the national average and pays one-half the national average price. Present farm and home use in the region is somewhat over 10,000 kilowatt-hours per customer per year and the average cost about 1.25 cents per kilowatt-hour.

TABLE IV.—*Sales of electric energy by rate schedules—fiscal year 1962*

Rate schedule	Millions of kilowatt- hours	Percent of total	Percent change from fiscal year 1961	Mills per kilowatt- hour
C-4 ¹	18,566	63.7	-3.0	2.18
F-4.....	34	0.1	-34.3	5.06
A-4 ¹	2,658	9.1	12.0	1.68
E-4 ¹	6,679	22.9	11.9	3.11
H-3.....	1,197	4.1	24.2	2.50
Space heating.....	23	0.1	64.3	1.00
Total.....	29,157	100.0	2.2	2.36

Major features of rate schedules:

- C-4..... Kilowatt-year rate for transmission system firm power.
- F-4..... Demand-energy rate for firm power.
- A-4..... Kilowatt-year rate for at-site firm power.
- E-4..... Demand-energy rate for firm power for resale to ultimate consumers.
- H-3..... Energy rate for dump, emergency, breakdown, or experimental service.
- Space heating..... Special space heating rate applicable in vicinity of Grand Coulee plant.

¹ Includes interruptible sales.

Transmission System

Bonneville Power Administration in a little over two decades has constructed one of the Nation's largest high voltage grid systems to carry power from the Columbia River power system and from large non-Federal projects to the region's load centers.

Addition of 384 circuit miles of high voltage transmission lines and 7 substations during fiscal year 1962 gives the Administration a network of 8,608 circuit miles of transmission line and 215 substations.

Transformer capacity was increased by 113,000 kilovolt amperes for a total of 14,585,747 kilovolt amperes, and the present system reactive capacitance of 2,538,670 kilovolt amperes was increased by 103,125 kilovolt amperes during the fiscal year.



A lineman tightens the guys on a new type of steel H-frame transmission structure carrying power from the Cougar Dam in the Willamette Basin to lower Willamette Valley load centers.

New Facilities Completed

Major facilities completed during the year were:

— An 80-mile, 345,000 volt line from Big Eddy substation near The Dalles, Oregon to Portland General Electric Company's McLoughlin substation southeast of Portland, Oreg., to increase transmission capacity into the Willamette Valley area from Mid-Columbia river generating plants.

— A 129-mile, 345,000 volt line from Chelan County Public Utility District's Rocky Reach hydroelectric project to Maple Valley near Seattle, Wash., to bring additional power to northwestern Washington.

— A 9-mile, double circuit 115,000 volt line to integrate the output of the Corps of Engineers' Ice Harbor hydroelectric project, on the lower Snake River, into the BPA system near Pasco, Wash.

— A 125-mile, 115,000 volt line between our Redmond, Oreg., substation and Harney Electric Cooperative near Burns, Oreg., to bring electric power service to presently unserved areas in southern Harney and Malheur Counties, Oreg., and northern Humboldt County, Nev.

— A 50,000 kilovolt ampere transformer addition to the Aberdeen substation to serve load growth in the Grays Harbor area of Washington.

Construction Under Way

Construction under way on key facilities at the end of the fiscal year included:

An 18-mile, 115,000 volt line from the Administration's Lebanon substation, initially to furnish construction power to the Corps of Engineers' Green Peter Dam in western central Oregon, and later to integrate generation from the dam into the BPA grid.

The Vantage Substation and 230,000-volt tap to the Midway-Columbia line to integrate the Wanapum project of the Grant County Public Utility District with the Administration's grid under long-term "wheeling" agreements.

A second 33-mile, 230,000-volt line between Chehalis and Longview, Wash., to reinforce the Administration's system in the Longview area of southwestern Washington.

A 46-mile, 115,000-volt line between Eugene, Oreg., and the Corps of Engineers Cougar project on the South Fork of the McKenzie River.



Work on BPA's new high voltage test center at J. D. Ross substation, Vancouver, Wash., is nearing completion. The new test center will make possible substantial savings through a centralized test unit for servicing of present high voltage transmission equipment from 115,000 to 500,000 volts.

Wheeling Program Grows

Bonneville Power Administration's wheeling program, making the Federal grid available for transmission of non-Federal generation to area load centers, continued its steady growth in fiscal year 1962.

Contractual energy transfers increased by 25 percent over the previous year, totaling 11 billion kilowatt-hours as compared to 8.8 billion. Deliveries from the Rocky Reach plant of the Chelan County Public Utility District, beginning in June 1961, accounted for most of the increase.

Long-Term Contracts

Power is being delivered under long-term firm capacity contracts from the Pelton project of the Portland General Electric Co., the Box Canyon project of the Pend Oreille Public Utility District, the Priest Rapids project of the Grant County Public Utility District, and the Rocky Reach project of the Chelan County Public Utility District.

Excess-capacity contracts cover power from the Swift project of the Pacific Power & Light Co., the Rock Island project of the Chelan County Public Utility District, the Priest Rapids project of the Grant County Public Utility District, and the Idaho Power Co.

Coordination Agreement

Principal non-Federal generating utilities of the region entered into a 1-year coordination contract with BPA during fiscal year 1962 to maximize power output of all Pacific Northwest generating projects. The agreement, a pilot plan for coordination of the region's power resources, will be necessary when the Columbia River Treaty is ratified by Canada.

The 1-year contract will provide the required experience in the complex scheduling of coordinating operation of over 100 projects represented by the participating utilities.

A new 1-year coordination agreement is under negotiation to provide additional experience and knowledge looking forward to a proposed long-term contract.

Extra High Voltage

Bonneville Power Administration initiated comprehensive test and development programs during fiscal 1962 for extra-high-voltage transmission in both alternating- and direct-current fields.

BPA's pioneering and technological advances in extra-high-voltage transmission for moving large blocks of power long distances will eventually save power consumers millions of dollars in lowered transmission costs and interregional coordination of power resources.

Test sections of several different types of 500,000-volt conductors have already been incorporated in an existing 345,000-volt line, preliminary to plans for a proposed 500,000-volt alternating-current line to carry John Day power to coast load centers.

Technical feasibility of direct-current transmission in moving large blocks of power long distances holds the potential for interregional and international power transmission, nullifying the present limitations of alternating-current transmission.

Approval has been received and plans are well advanced for installation of a 5-mile experimental direct-current transmission line from Big Eddy Substation near The Dalles, Oreg., toward John Day Dam. Preliminary investigations show direct-current transmission is feasible and more economical than alternating current for distances of 300 miles and upward where large blocks of power are involved. Alternating current is usually more economical for distances below 300 miles.



A new \$1 million consolidated supply service center has been completed at J. D. Ross Substation, Vancouver, Wash. The new salvage, rehabilitation, and sales building is expected to save over \$100,000 a year by consolidating the services formerly located in several different areas.

System Financial Highlights

System gross power revenues during Bonneville Power Administration's first quarter century amounted to \$880 million. These revenues were sufficient to cover operation, maintenance, marketing expenses, interest on the Federal investment in power, and depreciation of power facilities. Net system revenues on a cost basis were approximately \$52 million.

Sales Handicaps

Lack of long-term availability of firm power in the Federal system and installation of considerable non-Federal generation in BPA's marketing area in recent years has resulted in handicapping sales of available power. Starting with fiscal year 1958, private and public utilities curtailed their purchases of secondary power from Bonneville Power Administration as they began producing substantial amounts of power at their own plants.



A new type of guyed steel H-frame transmission structure, designed by Bonneville Power Administration engineers, is being erected on the Cougar-Willakenzie 115,000-volt transmission line. The new structures have the advantage of a much longer life than wood pole H-frame structures and at the same time are much less costly than the conventional steel tower transmission structures.

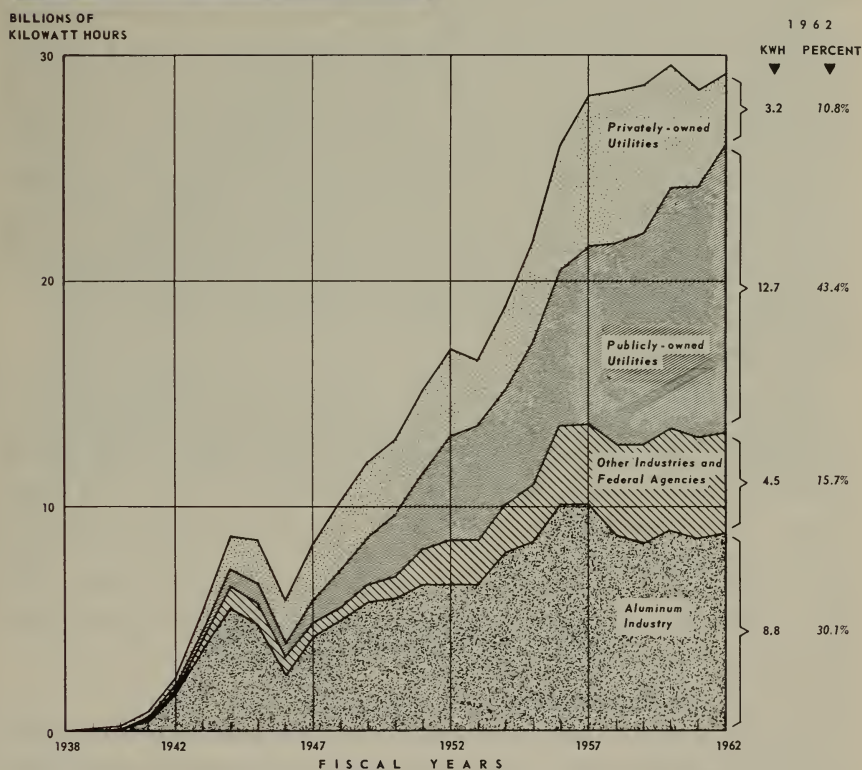
Economic conditions during these years caused the large electro-metallurgical industries, particularly aluminum, to curtail their operations and reduce their requirements of interruptible power. BPA has a surplus of secondary power and some short-term amounts of firm power. However, the temporarily available firm power is largely unsalable to Northwest industry because preference customers will require all of it within the next few years and therefore it cannot be offered for sale on long-term contracts.

Net Financial Results

Net financial results have been unsatisfactory during the past 5 years of operations. Revenues have been inadequate while at the same time additions to generating plants and the transmission system have increased costs. Nevertheless, revenues from the Columbia River power system since beginning of operations have been more than sufficient to meet expenses on a cumulative basis. A graphic comparison of salable resources and revenues is shown in the accompanying chart entitled "System Resources and Revenues."

Bonneville Power Administration in each deficit year had more unsold power than the total amount of the deficit. Estimates for the next 4 years indicate some improvement in sales but not sufficient to produce revenue equal to estimated costs.

Sales of Electric Energy by Class of Customer



Unsold Power

Unsold power in fiscal year 1962 represented \$28,300,000 in potential sales and the forecast for 1963 is \$27 million. The chart indicates there will be some decline in the amounts of unsold power during the next few years but even so, unsold power in fiscal year 1966 is estimated at \$16 million. However, it is estimated that all firm power will have been sold by that time.

Historically, Bonneville Power Administration has had no difficulty in marketing any available firm power on a long-term contractual basis. Therefore, if some means can be found of firming up the available secondary power or if secondary power can be marketed on an interregional basis, the revenue situation will undoubtedly improve.

Revenue Allocation

Bonneville Power Administration is the marketing agency for the Columbia River power system which consists of the power features of the Federal dams and the BPA transmission system in Oregon, Washington, northern Idaho, western Montana, and a corner of Nevada.

Revenues allocated to the Federal generating projects supplying the power which BPA markets amount to \$501,161,000 on a cumulative basis. Allocations to the generating projects are independent of the quantity of energy generated. They are scheduled to repay costs allocated to power plus required irrigation assistance. Actual allocations in recent years have been less than scheduled amounts for repayment for some projects because of unfavorable revenues. However, because of system payout surpluses accumulated in earlier years, the repayment of system investment continues to be somewhat ahead of schedule, approximately \$20 million as of June 30, 1962.

BPA Financial Status

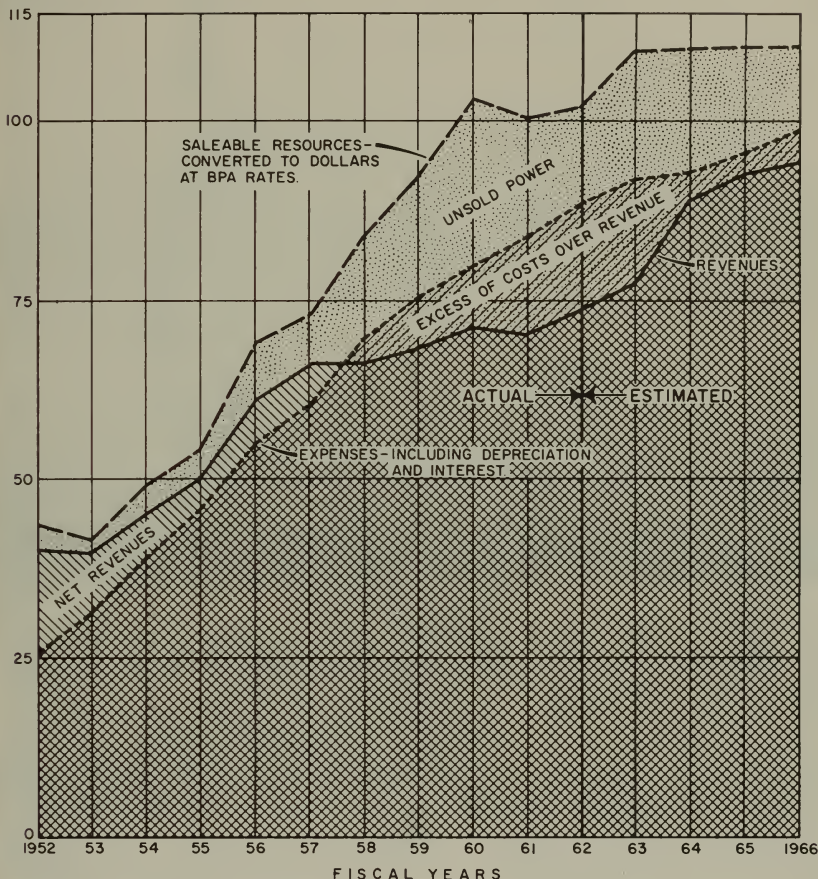
Bonneville Power Administration, separate and distinct from the Columbia River power system, is \$15,342,000 ahead of scheduled repayment requirements on a cumulative payout basis. This results because payout requirements have been somewhat lower than depreciation since beginning of operations. The difference is attributable to depreciation being computed on a straight-line basis whereas payout requirements are computed on a compound-interest basis. The latter method produces lower capital repayment requirements during the early period when interest payments are higher.

Fiscal Year Revenues

Gross revenues from electric operations increased almost \$5 million during fiscal year 1962. The increase resulted entirely in areas other than firm power sales. Sales of firm power actually were down slightly for the year.

United States Columbia River Power System System Resources and Revenues

MILLIONS
OF
DOLLARS



NOTE: Fiscal Year 1962 data are preliminary

Four factors contributed to the revenue increase:

1. Industries, particularly the aluminum industry, used somewhat larger amounts of interruptible power than in the previous year, although still considerably less than their potential. This accounted for \$1,232,000 of the increase. The somewhat better market conditions for aluminum were largely responsible for the increase in sales of interruptible power.



A helicopter is used to carry a steel tower leg across the Columbia River to an island for the Big Eddy-Chenoweth transmission line near The Dalles, Oreg.

2. Exchange power, between BPA and the utilities of the areas, both privately and publicly owned, increased considerably on a favorable basis and resulted in a revenue increase of \$979,000

3. Revenues from wheeling non-Federal power increased substantially during the year as both the privately and publicly owned utilities made greater use of the BPA transmission system to carry their own new generation to markets. Gross revenue increased \$1,636,000 from this source.

4. A 1-year coordination agreement between BPA and the privately owned utilities was negotiated whereby BPA received \$1,100,000 in additional revenue.

The following recapitulation compares fiscal year 1962 gross revenues by class with the prior year. Both wheeling and coordination

revenues, discussed above, are included in the "Miscellaneous" category.

[Thousands of dollars]

	Fiscal year 1962	Fiscal year 1961	Increase or (decrease)
Firm power.....	62,027	62,235	(208)
Interruptible power.....	3,897	2,665	1,232
Dump power.....	175	119	56
Exchange power.....	2,955	1,976	979
Miscellaneous power revenues.....	5,429	2,707	2,722
Total power revenues.....	74,483	69,702	4,781



As the helicopter holds the tower leg vertically, workers bolt it in place on the anchor strut.

Financial results of operations on a cost accounting basis for the Bonneville Power Administration for fiscal year 1962 compared with fiscal year 1961 are shown in summary form by tables V and VI. These data are necessarily preliminary because the annual audit by the General Accounting Office was not completed at the time these statements were prepared.

However, the final figures probably will not be materially different than those now available.

TABLE V.—*Bonneville Power Administration: Comparative statement of revenues and expenses, fiscal years 1961 and 1962 (preliminary)*

[Cost basis]

[Rounded to thousands of dollars]

	Total to June 30, 1962	Fiscal year 1962	Fiscal year 1961	Increase or decrease
Operating revenues:				
Sales of electric energy	\$854,291,000	\$69,054,000	\$66,995,000	\$2,059,000
Other electric revenues	24,444,000	5,429,000	2,707,000	2,722,000
Total operating revenues	878,735,000	74,483,000	69,702,000	4,781,000
Less revenues allocated to generating projects:				
Albeni Falls	11,175,000	1,400,000	1,200,000	200,000
Bonneville Dam	70,025,000	2,100,000	2,100,000	—
Chief Joseph	37,200,000	6,550,000	6,500,000	50,000
Columbia Basin Project	199,959,000	12,800,000	12,800,000	—
Detroit-Big Cliff	15,940,000	1,700,000	1,400,000	300,000
Hills Creek	75,000	75,000	—	75,000
Hungry Horse	34,906,000	3,833,000	3,833,000	—
Ice Harbor	1,500,000	1,500,000	—	1,500,000
Lookout Point-Dexter	13,150,000	1,750,000	1,400,000	350,000
McNary	80,935,000	8,825,000	8,200,000	625,000
The Dalles	34,320,000	8,500,000	10,800,000	(2,300,000)
Yakima-Kennewick	1,976,000	345,000	345,000	—
Total revenue allocated to generating projects	501,161,000	49,378,000	48,578,000	800,000
Operating revenues available to Bonneville Power Administration	377,574,000	25,105,000	21,124,000	3,981,000
Less operating expenses:				
Purchased power	11,212,000	1,090,000	697,000	393,000
Operation, maintenance, administration, etc.	146,591,000	13,238,000	12,292,000	946,000
Total operating expenses	157,803,000	14,328,000	12,989,000	1,339,000
Less interest and other deductions:				
Interest on Federal investment	100,838,000	9,759,000	9,259,000	500,000
Less amount charged to construction	8,629,000	371,000	555,000	(184,000)
Miscellaneous income deductions	1,266,000	(223,000)	24,000	(247,000)
Total interest and other deductions	93,475,000	9,165,000	8,728,000	437,000
Net available for depreciation	126,000,000	1,612,000	(593,000)	2,205,000
Depreciation	133,879,000	12,299,000	11,670,000	629,000
Net revenue for period	(7,583,000)	(10,687,000)	(12,263,000)	1,576,000
Cumulative net revenue beginning of year	—	3,104,000	15,367,000	(12,263,000)
Cumulative net revenue end of year	(7,583,000)	(7,583,000)	3,104,000	(10,687,000)

Revenues and Expenses

A comparative statement of the revenue and expenses of Bonneville Power Administration on a cost accounting basis is presented in

table V. The statement shows cumulative data to June 30, 1962, as well as comparative data for fiscal years 1961 and 1962.

TABLE VI.—*Bonneville Power Administration: Condensed statement of assets and liabilities as of June 30, 1961 and 1962 (preliminary)*

[Cost basis]

[Rounded to thousands of dollars]

	Fiscal year 1962	Fiscal year 1961	Increase or decrease
ASSETS			
Electric plant—original cost:			
Electric plant in service.....	\$504,718,000	\$471,364,000	\$33,354,000
Electric plant leased to others.....	463,000	445,000	18,000
Electric plant held for future use.....	1,611,000	879,000	732,000
Construction work in progress.....	13,802,000	31,997,000	(18,195,000)
Total electric plant.....	520,594,000	504,685,000	15,909,000
Less reserve for depreciation.....	117,518,000	106,683,000	10,835,000
Original cost less reserves.....	403,076,000	398,002,000	5,074,000
Current assets:			
Unexpended funds.....	17,261,000	13,652,000	3,609,000
Special funds.....	1,410,000	738,000	672,000
Accounts receivable:			
Customers.....	10,512,000	9,580,000	932,000
Others.....	230,000	356,000	(126,000)
Materials and supplies.....	4,201,000	4,524,000	(323,000)
Total current assets.....	33,614,000	28,850,000	4,764,000
Other assets and deferred charges.....	438,000	598,000	(160,000)
Total assets.....	437,128,000	427,450,000	9,678,000
LIABILITIES			
Investment of U.S. Government:			
Congressional appropriations.....	669,297,000	636,234,000	33,063,000
Transfers ¹	19,984,000	19,097,000	887,000
Interest on federal investment.....	100,837,000	91,078,000	9,759,000
Continuing fund.....	1,833,000	1,833,000	-----
Gross investment.....	791,951,000	748,242,000	43,709,000
Less funds returned.....	354,964,000	332,133,000	22,831,000
Net investment.....	436,987,000	416,109,000	20,878,000
Accumulated net revenues.....	(7,583,000)	3,105,000	(10,688,000)
Total investment.....	429,404,000	419,214,000	10,190,000
Current and accrued liabilities:			
Accounts payable.....	4,663,000	5,327,000	(664,000)
Employees accrued leave.....	2,506,000	2,472,000	34,000
Total.....	7,169,000	7,799,000	(630,000)
Deferred credits.....	555,000	437,000	118,000
Total liabilities.....	437,128,000	427,450,000	9,678,000

¹ Consists of goods and services furnished without charge by other Federal agencies less such items furnished to other agencies by Bonneville Power Administration.

After allocation of revenue receipts to the generating projects, the remaining revenues were \$1,612,000 more than the aggregate of BPA's expenses of operation, maintenance, marketing, administration, and interest for the year. This compares with a deficiency of \$593,000 for fiscal year 1961. After provision for \$12,299,000 depreciation expense, the net BPA deficit in 1962 was \$10,687,000 compared to \$12,263,000 in 1961.

Cumulatively through June 30, 1962, revenues available to BPA after allocations to the generating projects, amounted to \$377,573,000. These revenues exceed BPA's cumulative operating expense of \$157,781,000—plus cumulative interest and miscellaneous expenses of \$93,497,000—by \$126,296,000. The remaining \$126,296,000 was insufficient to provide for total depreciation amounting to \$133,879,000 as of June 30, 1962. This leaves a net deficiency of \$7,583,000 on the basis of cost accounting since beginning of operations.

Comparative Balance Sheet

Table VI is a statement of assets and liabilities on a cost accounting basis as of June 30, 1961 and 1962. Transmission electric plant in service aggregated slightly more than half a billion dollars at the end of fiscal year 1962, an increase of \$33,354,000 during the year. Construction work in progress decreased substantially during the year because of completions of plant under construction a year ago and the fewer new starts during the current year. The total expenditures for electric plant during the year were \$15,909,000.

The gross investment of the Federal Government in the Bonneville Power Administration increased \$43,638,000 in fiscal year 1962. This increase consists principally of \$32,992,000 in new appropriations for operation and maintenance and new construction plus \$9,759,000 in interest accrued on the unpaid investment owing the Treasury. Actual funds returned to the Treasury by Bonneville Power Administration, after deducting amounts allocated to the generating projects, totaled \$22,831,000 during the year. The unrepaid or net investment of the Federal Government increased only \$20,807,000 during the year.

Federal Investment Repayment

The gross amount of the Federal Government's investment in the Bonneville Power Administration together with the gross repayments made to June 30, 1962, and the remaining net investment are shown on table VII on a payout basis. From the beginning of operations through June 30, 1962, the Bonneville Power Administration has covered cash receipts into the Treasury amounting to \$856,125,000, of which \$501,161,000 has been allocated to the generating projects and \$354,964,000 to the transmission system.

Of this \$354,964,000 some \$134,674,000 went to repay all expenses of operation, maintenance, marketing and administration; \$92,209,000 went for interest on the transmission investment; and the balance of \$128,081,000 went for repayment of the capital investment. This exceeded scheduled capital repayment requirements of \$112,739,000

by \$15,342,000 and represented a 23.4-percent repayment of the total capital investment of \$547,807,000 at June 30, 1962.

TABLE VII. *Bonneville Power Administration—Summary of Federal investment in transmission system and repayment as of June 30, 1962 (preliminary)*

[Payout basis]

[Rounded to thousands of dollars]

	Gross investment	Repayments	Net investment
Investment in current expenses:			
Operation, maintenance, etc.....	134, 674, 000	134, 674, 000	-----
Interest.....	92, 209, 000	92, 209, 000	-----
Total current expenses.....	226, 883, 000	226, 883, 000	-----
Investment in capital assets:			
Electric plant and other capital assets.....	547, 807, 000	¹ 128, 081, 000	419, 726, 000
Unexpended appropriations.....	17, 190, 000	-----	17, 190, 000
Total capital investment.....	² 791, 880, 000	² 354, 964, 000	436, 916, 000

¹ Consists of \$112,739,000 scheduled amortization and \$15,342,000 repaid in excess of scheduled requirements. The total repayment \$128,081,000 equals 23.4 percent of the invested capital of \$547,807,000.

² Total cash receipts covered into U.S. Treasury by BPA to June 30, 1962..... \$856, 125, 000

Less amounts allocated to generating projects..... 501, 161, 000

Cash receipts allocated to Bonneville Power Administration..... 354, 964, 000

Intertie Report Completed

A departmental task force study on the feasibility of a Pacific Northwest-Pacific Southwest intertie was completed in November 1961.

Major findings and recommendations were:

— A 750,000-volt direct-current common-carrier transmission line could produce profits of about \$6 million annually and two such lines about \$15 million a year over the 50-year payout period.

— BPA should not propose to sell power to California customers until Congress has had a chance to act on legislation giving the region first call on all Federal power produced therein.

— BPA should immediately launch a test and development program to make available the economies of high-voltage direct-current transmission for moving large blocks of power over long distances.

— The proposed intertie would be mutually beneficial to both regions through interchange of peaking power, sale of secondary power to displace steam-generated power in California, and firm up 200,000 to 400,000 kilowatts of Pacific Northwest secondary power by moving a small amount of offpeak California steam power to the north.

Safeguard Legislation

The Secretary of the Interior in January 1962 submitted legislation to Congress designed to give Pacific Northwest customers, both public and private, first call on all power generated in the region.

The legislation prepared by BPA in consultation with its customers, Governors of the affected States, and other interested parties assures that all power needs of Northwest customers will be met before any power is shipped outside the region.

The Secretary strongly urged congressional action on the "region of origin" legislation to assure permanent legislative and contractual safeguards for electric power and energy now or hereafter generated on the region's rivers and streams.

Administrator Luce urged that no tie-line, public or private, be built before Congress can act on the "region of origin" protective legislation.

Hanford Steam Generation

The Washington Public Power Supply System, a combine of 16 public utilities, proposed to finance, construct, and operate steam-generating facilities at the new Hanford reactor after Congress had refused to authorize Federal construction of the facilities.

WPPSS would contract with AEC for lease of land, purchase of reactor byproduct steam and other necessary arrangements. The power output of the reactor, estimated at 800,000 kilowatts, would be integrated into the BPA grid and marketed by BPA. BPA in turn, would make available to WPPSS an amount of firm power which at BPA rates is equivalent to the annual financing, operating and maintenance costs of the generating facilities.

As a result of a General Accounting Office legal opinion that the Atomic Energy Commission does not have authority to enter into the necessary contracts, specific congressional authorization for the project became necessary.

Legislation to authorize the WPPSS proposal was before Congress as the 1962 fiscal year ended.

Canadian Treaty

A continuing liaison and exchange of technical information was maintained during the year with Canadian governmental representatives on various aspects of the Canadian treaty. Ratification of the treaty by Canada is again expected to come up for consideration when the Parliament convenes in September of this year.

The increased downstream generation at U.S. plants resulting from the Canadian storage would be equally divided between the two

BENEFITS FROM TREATY BETWEEN UNITED STATES AND CANADA

1972-73 LEVEL OF DEVELOPMENT

6.94 BILLION KILOWATT HOURS
OF AVERAGE ANNUAL ENERGY
RETURNED TO CANADA

6.94 BILLION KILOWATT HOURS NET ADDITIONAL
AVERAGE ANNUAL ENERGY TO UNITED STATES

15.5 MILLION
ACRE FEET
OF STORAGE

Mica
Arrow Lakes
Duncan Lake

DUNCAN LAKE

ARROW LAKES

LIBBY

Grand Coulee
Chief Joseph
Wells
Rocky Reach
Rock Island
Wanapum
Priest Rapids
McNary
John Day
The Dalles
Bonneville



countries. The proposed construction of three large storage dams in Canada and construction of Libby Dam in Montana would add initially about 2 million kilowatts of firm power to BPA resources.

Future Power Outlook

Normal load growth of the Pacific Northwest is now 400,000 kilowatts of firm average energy per year and will reach 600,000 kilowatts a year by 1975. Even if the Hanford reactor project, the Canadian

treaty and the California intertie are all realized, new hydro projects will have to be authorized soon and constructed if the region's load growth by 1975 is to be met.

Even with full and timely development of remaining feasible hydro projects, the region will have to rely increasingly on steam generation by the mid-1970's. Without the Canadian treaty, the region would require more steam and require it sooner by at least 2 years than with the treaty.

The power needs of the region can be met only through the most intensive efforts of both the Federal and non-Federal public and private utilities in supplying an adequate energy base for the Pacific Northwest's economic growth.

Economic Base Studies

Bonneville Power Administration in fiscal year 1962 launched an intensive economic study of the Pacific Northwest in terms of power requirements to 1985. The study will review the economic capabilities of the region as a basis for powerload forecasts, transmission system planning, and identifying the economic potentials of specific industries.

All basic outlines and assumptions for the study have been prepared by BPA to assure consistency on a regional basis and technical accuracy. To minimize staff requirements, contracts for specific sections of the study have been let to the research bureaus of four State universities, the U.S. Forest Service and Economic Research Service of the Department of Agriculture, Bureau of Mines and Geological Survey of the Department of Interior, General Services Administration, and three private concerns.

Departmental Requests

Near the close of the fiscal year, the Secretary of the Interior requested BPA to undertake two special studies, a survey to determine whether all of the State of Idaho should be included in Bonneville Power Administration's marketing area, and preliminary investigation of the feasibility of a transmission intertie between the Pacific Northwest and the Missouri River basin systems.

A majority of the Idaho congressional delegation asked the Secretary to initiate the Idaho study. Their request held that economy and industrial development of southern Idaho was being handicapped by not having access to low-cost Columbia River power. The study is being made in cooperation with the Bureau of Reclamation and is scheduled for completion by October 15, 1962.

The report on feasibility of a Missouri Basin-Pacific Northwest intertie is scheduled for completion in July 1963.

Southwestern Power Administration

Douglas G. Wright, *Administrator*



For fiscal 1962, Southwestern Power Administration of the Department of the Interior received \$1,310,000 by direct appropriation for its operation and maintenance program and \$950,000 for its construction program. Additional funds in the amount of \$294,837 remained available for completion of the previously approved construction program. Authorization by the Congress made \$5 million available out of receipts to cover all costs in connection with the purchase of power and energy and the rental of transmission facilities.

Gross revenues for Southwestern Power Administration for fiscal year 1962 were \$15,953,392, representing an increase of \$1,000,381, or 6.7 percent over the gross revenue for fiscal year 1961. During fiscal year 1962, sales to private electric utilities accounted for 19 percent of the revenue dollar; defense industry (aluminum), 12 percent; electric cooperatives, 56 percent; municipalities, 10 percent; and public authorities, 3 percent.

As of June 30, 1962, the original cost of Southwestern Power Administration transmission facilities totaled \$28,753,576.

Marketing

Contractual arrangements in the Missouri area were submitted during fiscal 1962 for approval in fiscal 1963 for one of the Nation's most completely coordinated electric power supply operations, integrating electric energy produced from steam generating plants owned and operated by six REA electric power cooperatives and three investor-owned power companies with large blocks of hydroelectric

TABLE I.—Source and application of funds

Funds provided:	June 30, 1961	June 30, 1962
Congressional Appropriations (net).....	\$42, 498, 722. 85	\$44, 745, 409. 96
Accountability for transfer of cost or property to or from other Government agencies (net).....	742, 036. 95	884, 456. 07
Gross operating revenue and other income.....	99, 967, 234. 51	116, 060, 081. 78
Total funds provided.....	143, 207, 994. 31	161, 689, 947. 81
Funds applied:		
Returned to U.S. Treasury ¹	39, 118, 109. 08	45, 122, 524. 95
Accumulated operating expenses.....	74, 201, 673. 83	93, 268, 236. 58
Less nonfund depreciation and amortization expense.....	(6, 109, 085. 21)	(6, 846, 809. 03)
Electric plant.....	27, 832, 216. 71	28, 753, 575. 60
Special and trust funds.....	5, 561, 943. 60	5, 280, 800. 49
Cash.....	2, 971, 808. 61	3, 348, 076. 66
Accounts receivable.....	1, 214, 809. 05	1, 247, 567. 57
Other current and accrued assets.....	20. 00	25. 00
Material and supplies.....	581, 783. 42	661, 375. 38
Prepayments and advances.....	2, 139. 65	1, 048. 25
Deferred debits.....	2, 055. 18	2, 372. 27
Less accrued and other nonfund items.....		
Accounts payable.....	(613, 865. 43)	(550, 633. 68)
Accrued payroll.....	(23, 399. 86)	(26, 024. 45)
Accrued leave.....	(117, 863. 22)	(133, 581. 26)
Contributions in aid of construction.....	(62, 468. 34)	(65, 032. 20)
Accrued interest on invested capital.....	(1, 351, 882. 76)	(8, 373, 574. 32)
Total funds applied.....	143, 207, 944. 31	161, 689, 947. 81

¹ Total funds returned to the U.S. Treasury. No allocation of revenue has been made to the Corps of Engineers to date.

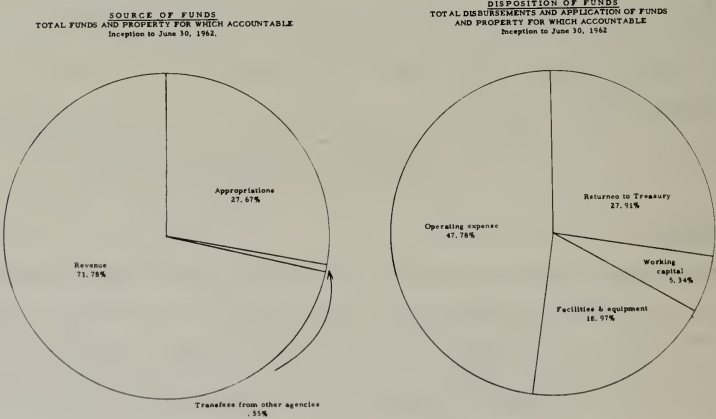


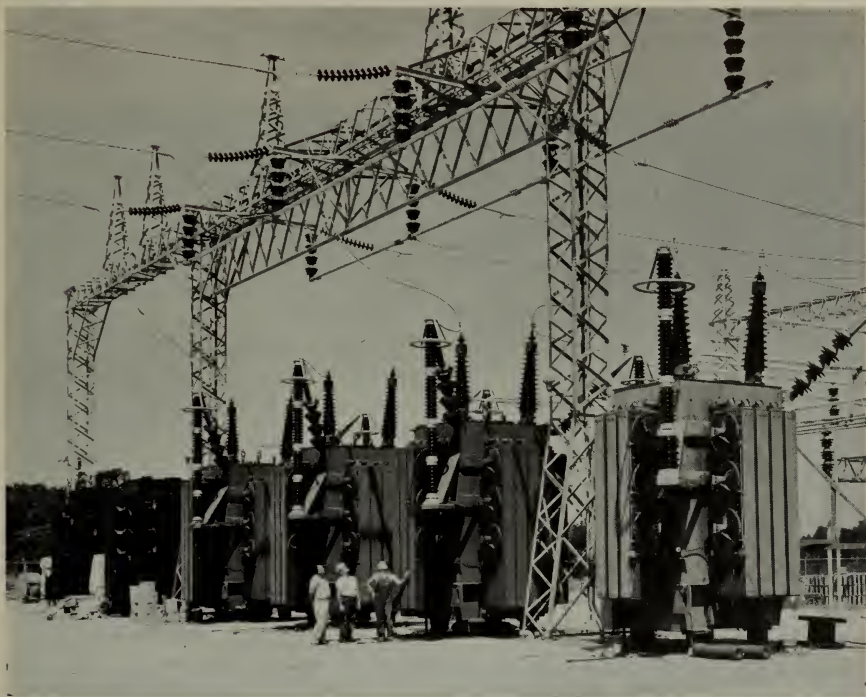
Table No. II

energy produced from the federally owned Bull Shoals and Table Rock Dam projects on the White River in Missouri.

Under this arrangement, SPA will be marketing approximately one-half million kilowatts of hydroelectric power, realizing for the Government a gross revenue averaging between \$9 and \$10 million a year.

A power marketing arrangement was made between SPA, the city of Columbia, Mo., and Central Electric Power Cooperative of Jefferson City, Mo. Under this arrangement SPA sells excess energy and interruptible capacity to the city of Columbia, through the system of Central Electric Power Cooperative.

Negotiations were continued with Western Farmers Electric Cooperative serving western Oklahoma. Problems have been resolved, basic premises established, and cost and load data developed for renegotiation of the SPA-Western Farmers power and transmission agreements.



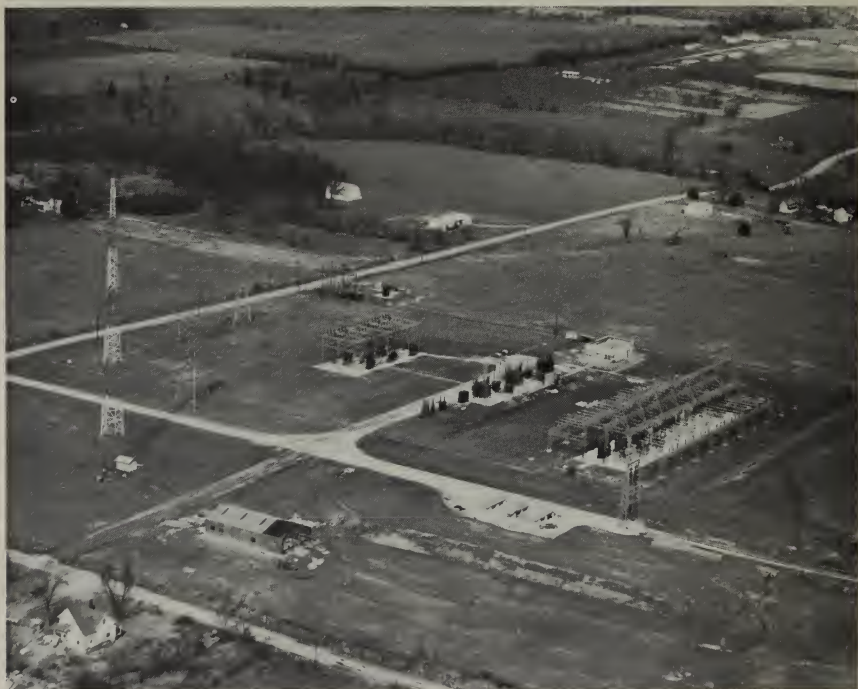
Six 10,000-kilovolt single-phase 161/138 transformers are installed in the Weleetka Substation, Weleetka, Okla., serving the South Branch of SPA customers.

Sales

SPA's electric power sales in fiscal year 1962 increased to 689,793 kilowatts from 554,520 kilowatts in fiscal year 1961, an increase of 24.4 percent. The sales were made to 32 public bodies, 9 REA electric distribution cooperatives, 9¹ REA electric generation and transmission cooperatives, 1 defense industry (aluminum), and 6 private electric utilities. The sales of kilowatt-hours of energy by class of customer are set out below:

	<i>Fiscal year 1962¹ millions of kw.-hr.</i>
Municipalities.....	262. 6
REA electric cooperatives.....	1, 359. 5
Public authorities.....	69. 3
Defense industry (aluminum).....	549. 0
Private electric utilities.....	125. 2
Total.....	2, 365. 6

¹ Compiled by billing periods.



Aerial view of the Springfield, Mo., substation and dispatching center. The Springfield Substation serves as the dispatching hub for all of the White River hydropower projects.

Power Production

Resources

Completion of installation of the final two units at Table Rock (50,000 kilowatts each) and two additional 45,000-kilowatt units at Bull Shoals during the year increased the installed hydroelectric capacity in Southwestern Power Administration's system to 791,000 kilowatts. The installed and dependable capacity and current capability of the hydro and steam electric plants in the system are shown in table III.

Energy Production

Inflows into the interconnected system projects were approximately 220 percent of median for the first 8 months of fiscal year 1962 and only 79 percent of median for the last 4 months, with average flow for the year being approximately 173 percent of median. Storage in the reservoir system was 125 percent of full pool at the beginning of the fiscal year with flood storage in four of the six interconnected projects, and was approximately 90 percent full on June 30, 1962.

TABLE III.—*Capability data*

Project or plant	State	River basin	Installed capacity	Dependable capacity	Capability June 30, 1962
Hydroelectric:					
Interconnected system:					
Bull Shoals ¹	Arkansas.....	White.....	250,000	162,000	288,000
Denison.....	Oklahoma-Texas.....	Red.....	70,000	54,000	80,000
Fort Gibson.....	Oklahoma.....	Grand.....	45,000	45,000	48,000
Norfolk.....	Arkansas.....	White.....	70,000	56,000	80,000
Table Rock.....	Missouri.....	do.....	200,000	138,000	230,000
Tenkiller Ferry.....	Oklahoma.....	Illinois.....	34,000	28,000	39,000
Subtotal.....			669,000	483,000	765,000
Isolated plants:					
Blakely Mountain ²	Arkansas.....	Ouachita.....	75,000	75,000	75,000
Narrows.....	do.....	Little Missouri.....	17,000	14,000	19,000
Whitney.....	Texas.....	Brazos.....	30,000	24,000	28,000
Subtotal.....			122,000	113,000	122,000
Total hydroelectric.....			791,000	596,000	887,000
Steam:					
Central Electric Power Co-op.....	Missouri.....		15,000	16,000	16,000
N.W. Electric Power Co-op.....	do.....		40,000	42,000	40,000
Western Farmers Electric Co-op.....	Oklahoma.....		30,000	31,000	31,000
Total steam.....			85,000	89,000	87,000
Grand total.....			876,000	685,000	974,000

¹ Commercial operation dates:

Unit No. 5..... Jan. 16, 1962

Unit No. 6..... Feb. 8, 1962

² By contract.

TABLE IV.—SPA total system net hydro generation, fiscal years
[Millions kilowatt-hours]

Year	Bull Shoals	Denison	Fort Gibson	Norfolk	Ten-killer	Table Rock	Inter-connected system	Narrows	Blakely ¹ Mountain	Whitney	Grand total
Total to June 30, 1950	-----	1,099.1	-----	1,066.7	-----	-----	2,165.8	3.1	-----	-----	2,168.9
1951	-----	254.6	-----	207.6	-----	-----	482.2	29.4	-----	-----	491.6
1952	-----	142.6	-----	338.9	-----	-----	481.5	42.5	-----	-----	524.0
1953	-----	92.4	-----	126.8	-----	-----	521.5	47.4	-----	-----	569.3
1954	270.2	192.4	32.1	132.8	43.3	-----	742.7	17.8	-----	0.4	780.7
1955	334.7	140.2	39.5	23.7	54.6	-----	530.3	29.2	-----	20.2	580.6
1956	386.6	197.0	70.7	105.5	38.4	-----	802.3	21.2	-----	30.1	580.6
1957	651.9	144.5	74.8	204.3	61.9	-----	1,134.8	39.8	66.1	48.6	938.2
1958	991.7	245.4	146.7	248.2	118.0	-----	1,730.0	45.8	219.3	71.2	1,465.1
1959	488.1	109.4	161.3	208.8	106.7	-----	1,084.0	25.2	177.0	83.2	2,056.0
1960	418.6	266.9	271.8	174.4	126.7	10.2	1,471.2	30.4	175.8	37.7	1,323.2
1961	546.9	223.8	209.7	196.5	104.3	212.8	1,665.1	39.8	155.6	69.4	1,726.6
1962	743.9	213.3	308.5	164.8	138.8	385.1	2,001.0	37.7	198.9	83.0	1,987.2
	-----	-----	-----	-----	-----	431.7	-----	-----	171.6	64.3	2,274.6
Total	5,072.5	3,321.6	1,387.7	3,199.0	792.7	1,039.8	14,813.2	409.3	1,164.3	508.1	16,895.0

¹ Generation delivered into Arkansas Power & Light Co. system. By contract, 142,000,000 kw.-hr. per year of firm energy is delivered into SPA system.

As a result of the exceptionally high flow during the first 8 months of the fiscal year, the total net hydroelectric generation during fiscal year 1962 was 2,274.6 million kilowatt-hours, the maximum annual generation of record for the system (table IV). The net generation by fiscal years for the nine Federal projects currently in operation is shown in table IV.

G & T steam electric plants produced 111,157,700 kilowatt-hours for marketing by SPA during fiscal year 1962, with distribution between plants as follows:

	<i>Kilowatt-hours</i>
Central Electric Power Cooperative.....	10, 212, 000
Northwest Electric Power Cooperative.....	77, 758, 000
Western Farmers Electric Cooperative.....	23, 187, 700
Total.....	111, 157, 700

In addition to the generation from the Federal hydroelectric and G&T thermal electric plants, whose output is marketed by SPA, additional energy was received from other sources in the amount of 114,926,000 kilowatt-hours for delivery to SPA customers during fiscal year 1962.

Major Program Accomplishment

In August 1961, representatives of this Administration presented testimony on pumped storage in a hearing before the Irrigation and Reclamation Subcommittee of the House Interior and Insular Affairs Committee.

During 1962 considerable investigation was made of the pumped storage potential available in the SPA area. A cooperative study was made by the Corps of Engineers, Southwestern Division, and SPA of a number of sites in the Arkansas River basin, which included preliminary cost and benefit analyses. The report, dated February 26, 1962, was forwarded by the Southwestern Division, Corps of Engineers, to the office of their Chief of Engineers for review. This report indicated that, while all sites investigated were economically feasible, the apparently better site was on Petit Jean Mountain immediately above lock and dam No. 9 on the Arkansas River. This site could be developed with installed capacity up to 700,000 kilowatts. Another excellent site considered in the study, immediately above Ozark lock and dam and designated as the White Oak site, was only slightly less favorable than the Petit Jean site. The Committee on Public Works of the U.S. Senate approved on April 10, 1962, a resolution requesting

a review of reports on the Arkansas River and tributaries, published in House Document 758, 79th Congress, and other pertinent reports "with a view to determining the advisability of modifying the recommendations contained therein, with particular reference to provide pumped storage hydroelectric power developments in connection with the Ozark lock and dam and lock and dam No. 9, Arkansas River, Ark., and other possible sites."

SPA-MRB Interconnection

The study of a high-voltage interconnection between the Missouri River basin and the Arkansas River basin culminated in the completion of an interim feasibility report of an interconnection between the transmission systems of SPA and Reclamation's eastern division of the Missouri River basin. This report was completed in March 1962, and subsequently approved by the Department.

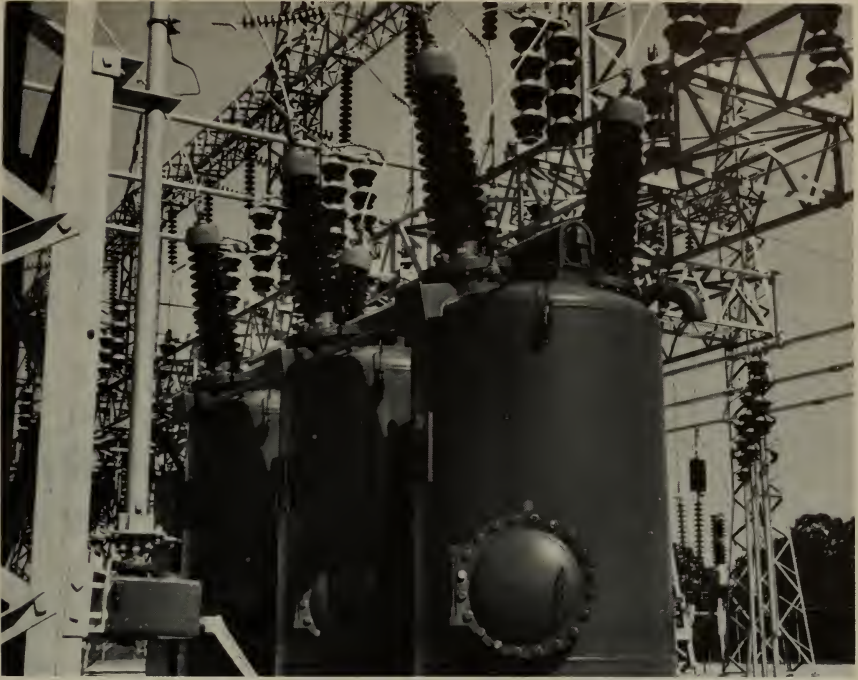
This report determined that it would be economically feasible to make a 161-kilovolt interconnection for the interchange of capacity between the two areas. The interconnection would also reduce the obligation for reserve generating capacity in one area by temporary transfer of its obligation to the other areas, permit the exchange of emergency power, and meet the traditional trend for more complete integration of major power systems.

AC Network Analyzer

During the past year SPA acquired and installed at the Federal Center in Denver, Colorado, for joint use with the Bureau of Reclamation an AC network calculator. This analog computer will assist in planning studies of the interconnected transmission facilities of SPA, G&T cooperatives, and the private utilities of the Southwest.

EHV-Pumped Storage Investigation

In preliminary discussions of EHV potentialities and the coordination of EHV investigations with pumped storage studies it was noted that for each 100 miles of 500-kilovolt line, approximately 150,000 kilowatts of hydroelectric generating capacity could be utilized to provide reactive and synchronous condenser needs. In April 1962 SPA prepared a preliminary report of a combination consisting of a potential 500,000-kilowatt pumped storage generating plant with a 90-mile EHV transmission line which would be a portion of the proposed Southwest Power Pool EHV system. The potential pumped storage unit was located at the Petit Jean site near lock and dam No. 9 on the Arkansas River. The EHV line was considered as in place between the generating plant and Fort Smith, Ark., and a part of



138-kilovolt oil circuit breakers are installed in the Weleetka Substation, Weleetka, Okla., with the latest safety devices.

the proposed Southwest Power Pool line between Oklahoma City, Okla., and Memphis, Tenn. The preliminary report was approved by the Department.

Interconnected Hydro System Studies

Additional programs for the IBM 1620 ADP equipment will be prepared in order that a wide range of studies with many varying factors may be made for the present and future interconnected hydroelectric system. In addition to operational studies, programs will also be prepared for the determination of the probability of occurrence of pertinent conditions which affect hydroelectric power operations.

Southeastern Power Administration

Chas. W. Leavy, *Administrator*

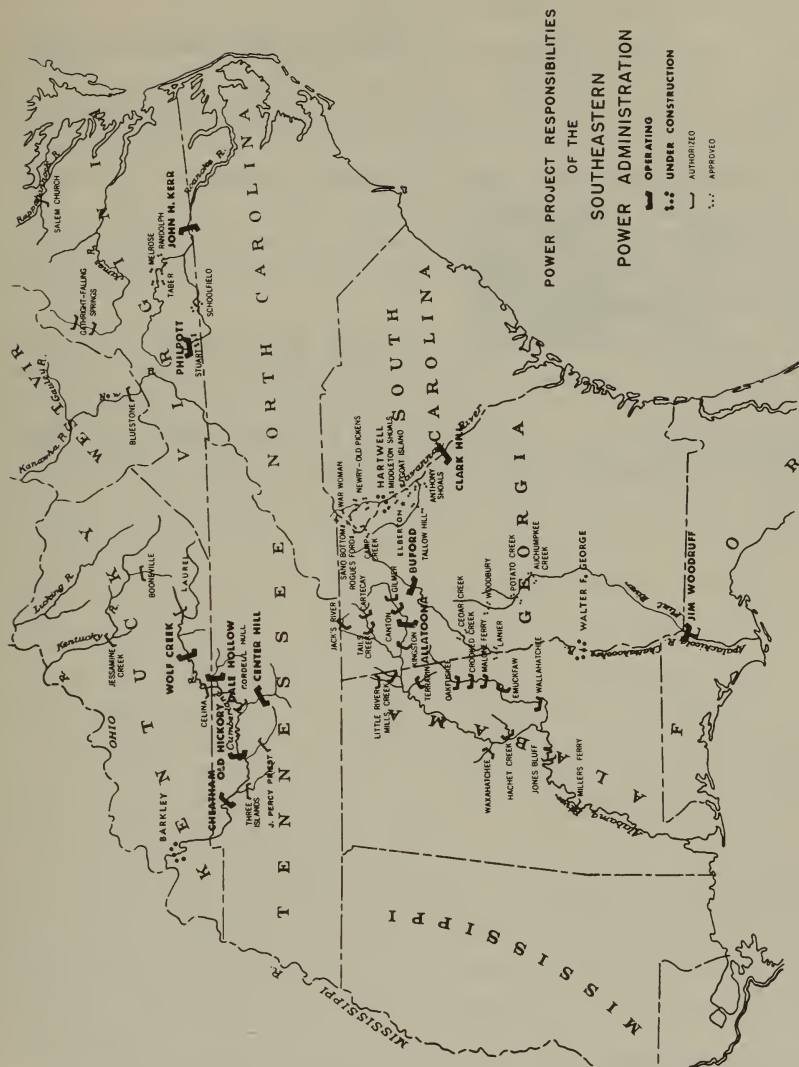


During fiscal 1962, Southeastern Power Administration marketed 1,399,400 kilowatts of capacity (with peak generation of 1,626,980 kilowatts) and 4,424,360,914 kilowatt-hours of energy. It was sold to 52 public bodies, 74 rural electric cooperatives, 1 Federal agency, and 4 privately owned utilities. Sales during the year earned \$23,211,811.86, as compared with \$19,711,259.50 for the previous year, bringing the revenues earned in all years to total \$154,193,553.74.

The output was generated at 12 Corps of Engineers projects. They were Wolf Creek, Dale Hollow, Center Hill, Old Hickory, and Cheatham projects in Kentucky and Tennessee; the Allatoona and Buford projects in Georgia; the Clark Hill and Hartwell projects in Georgia and South Carolina; the Jim Woodruff project in Florida; and the John H. Kerr and Philpott projects in Virginia.

The installed generating capacity of 1,349,600 kilowatts includes the first 66,000-kilowatt unit which was placed in commercial operation at Hartwell project during the year. Construction by the Corps continued on three projects (Walter F. George in Georgia and Alabama, Hartwell in Georgia and South Carolina, and Barkley in Kentucky). The construction underway will add 458,000 kilowatts of installed capacity.

The combined output of Wolf Creek, Center Hill, and Dale Hollow projects continued to be sold to the Tennessee Valley Authority under a long-term contract. The entire output of the Old Hickory and Cheatham projects was sold under another long-term contract with the Authority. Under a contract providing for the integrated operation of the Philpott and Kerr projects, the output of Philpott and



two-thirds of the Kerr project output were sold to the Virginia Electric & Power Co. and to 17 cooperatives in Virginia and North Carolina; the remainder of the Kerr output continued to be sold under long-term contracts to Carolina Power & Light Co., and to 16 public bodies and cooperatives in North Carolina.

Part of the Clark Hill project output was sold under long-term contracts to two public bodies in South Carolina. The one-half of the output of the Clark Hill project, the output of the first unit at the Hartwell project, and the entire output of the Allatoona and Buford projects were sold under long-term contracts to Georgia Power Co. and 88 public bodies and cooperatives in Georgia.

The output of the Jim Woodruff project was sold under long-term contracts to the Florida Power Corp. and six public bodies and cooperatives in Florida.

The Congress appropriated for the fiscal year \$334,000 for headquarters operation and maintenance, and \$466,000 for the purchase of firming energy and the payment of wheeling fees. Southeastern's working force numbered 33 employees at the beginning of the fiscal year and 39 employees when the year ended.

Office of Saline Water

Charles F. MacGowan, *Director*



Redoubled efforts to develop low-cost saline water conversion processes were made possible by the enactment of the Anderson-Aspinall Act (Public Law 87-295), which President Kennedy approved on September 22, 1961. This new law authorized \$75 million for saline water conversion research and development activities during fiscal years 1962 to 1967, inclusive. The previous authorization provided \$10 million for an 11-year period.

The initial appropriation for research and development work in fiscal year 1962 was \$1,755,000. Following the approval of the Anderson-Aspinall Act, a supplemental appropriation to immediately accelerate the pace of research increased this amount to \$5,255,000, and for fiscal year 1963 the Congress has appropriated \$7,600,000—a fourfold increase in a single year.

Through its publications and press releases, by participation in technical meetings, and by sponsoring or cosponsoring symposia and conferences, the Office of Saline Water has endeavored to attract the interest of scientists and other technically qualified persons to the problems associated with the development of low-cost conversion processes.

Some of the activities sponsored by the Office of Saline Water or in which members of the staff participated include the Woods Hole Conference, a month-long study jointly sponsored by the Office of Saline Water and the National Academy of Sciences-National Research Council, to outline a long-range fundamental research program; a symposium "Fresh Water From the Sea," sponsored by the European



Secretary of the Interior Stewart L. Udall (on the right) samples fresh water converted from the ocean with left to right, former Secretary of the Interior Oscar L. Chapman, Under Secretary James K. Carr, and Senator Clinton P. Anderson of New Mexico, all of whom participated in the Department of the Interior Conference on Saline Water Conversion which was held in the Department Auditorium, Washington, D.C., on March 28, 1962.

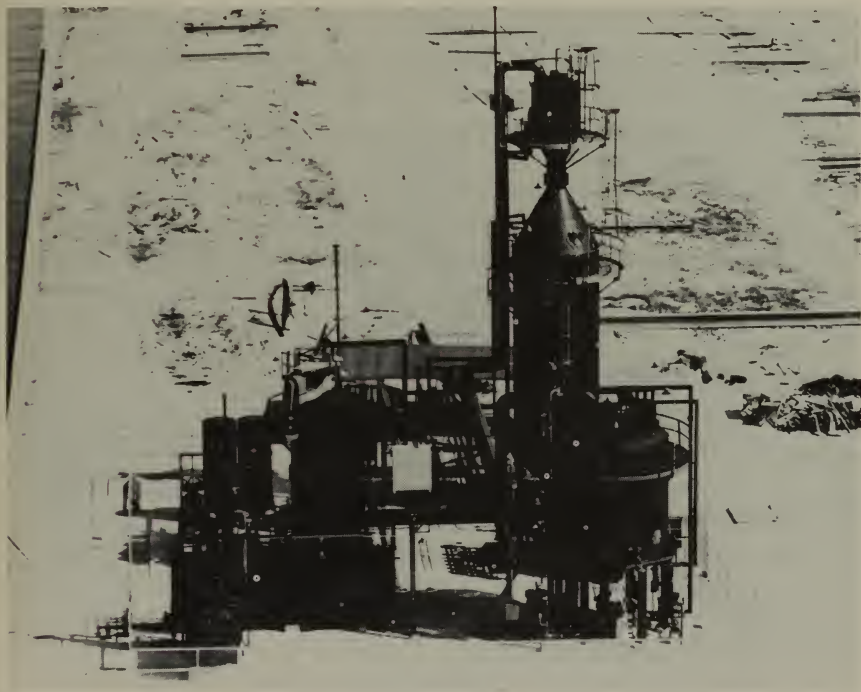
Federation of Chemical Engineering in Athens, Greece; symposia sponsored by the American Chemical Society, the American Institute of Chemical Engineers, and the American Society of Mechanical Engineers; papers on saline water conversion were presented to the Parliamentarians Conference of the North Atlantic Treaty Organization, Paris, France; the International Congress on Water Supply, Berlin, Germany; and the United Nations Conference on New Sources of Energy, Wind, Solar, and Geothermal, in Rome, Italy. As a result of the paper delivered in Paris, the NATO Parliamentarians designated the Office of Saline Water to be the clearinghouse for saline water conversion information throughout the free world. A 1-day Department of the Interior Conference on Saline Water Conversion held in the Department Auditorium on March 28, was attended by over 500 persons.

The success of this program is reflected in the increasing number of meritorious proposals now being submitted to the Office of Saline Water for evaluation.

Basic Research

The primary objective of the Division of Research is to increase knowledge and understanding in scientific fields relevant to the recovery of pure water and valuable byproducts from saline waters. Further, it maintains liaison with the scientific community to insure that significant advances in the improvement of water and the obtaining of minerals from saline water are integrated with Department of the Interior interests. Past research and development activities of the Office of Saline Water have been largely concerned with known processes and their kinetics.

It has become apparent that further rapid reduction in costs of converted water will require new approaches that are not available in present processes. Consequently, emphasis is being placed on



General view of a 35,000-gallon-per-day saline water conversion pilot plant erected at St. Petersburg, Fla., to develop a new freeze-conversion process.

fundamental principles in the expanded research and development program authorized by the 87th Congress. Thus, research activities are concerned primarily with new concepts, ideas, and scientific knowledge that are generally applicable to any process of saline water conversion. This involves studies of fundamental concepts in all areas of science and engineering.

Inorganic Chemistry

The Branch of Inorganic Chemistry is supporting a variety of research projects including the removal of calcium and magnesium (scale-forming elements) and potassium from sea water, solvation of polyvalent anions, behavior and properties of water, polyhedral clathrate hydrates, water research at Oak Ridge National Laboratory, and many others. These projects are in two general fields of interest; namely, The Composition, Structure, and Properties of Water and Aqueous Systems; and Kinetics, Thermodynamics, and Transport in Systems Containing Water.

For most desalination processes, inefficiencies arise largely from the transport of energy or matter at phase boundaries. High transport rates operate to cause concentration gradients which oppose the process and introduce additional inefficiencies. Also, large losses are introduced when significant temperature differences are required to supply needed energy by heat transfer to the system across its boundaries. For these reasons, increasing program emphasis is being placed on the process of mass and energy transport at phase boundaries. An accompanying effort is to achieve a comprehensive theoretical understanding of water and its solutions. Further, increasing consideration will be given to the theory of the liquid state itself, an area where scientific knowledge seriously lags behind that of either the gaseous or solid states.

Physical Chemistry

The Physical Chemistry Branch in the Division of Research is sponsoring fundamental research on mechanism of water transport across membranes and on membranes with controllable pore sizes. In addition, basic research on adsorption of ions, ion exchange, and electrochemical processes for water desalination are underway. Additional studies include, among others, coatings on metallic surfaces, energy transfer, mechanism of boiling, and the influence of acoustical vibrations on solid-liquid interfaces.

Organic and Biological Chemistry

The Branch of Organic and Biological Chemistry, recently established, is currently supporting work on salt transport, salt toleration,

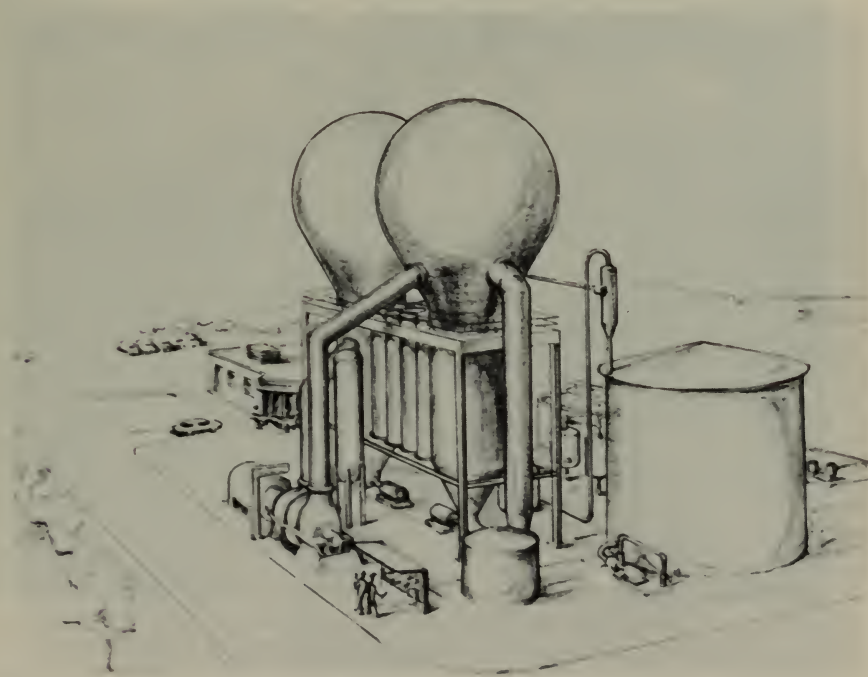
and sensitivity of plants. Future efforts of the Branch will be concerned with the development of a research program in those biological sciences where areas of relevancy to the overall problem of water desalination can be developed. Pertinent studies of interest will be initiated in the fields of biological membranes, synthetic membranes, physiological mechanisms of salt and water transport, ion binding and release, chelation, enzyme systems, genetics, and fluid dynamics.

Physics

The work sponsored by the Branch of Physics relates to investigations of a thermoelectric heat pump, crystallization, energy transfer, nucleation, effects of electrostatic and electromagnetic fields on concentration of ions at interfaces and as a means of separation.

Materials

Currently the Branch of Materials is supporting investigations dealing with the mechanism of scale formation and means of alleviating the problem, basic studies on corrosion of selected pertinent materials,



Artist's conception of the 1-million-gallon-per-day saline water conversion demonstration plant at Roswell, N. Mex., now under construction.

heat transfer rates, thermodynamic properties of sea water, and coatings.

Economics

The Branch of Economics has formulated two quite specific programs: one with short-range and the other with long-range objectives. Under the former, two projects are actively being pursued; namely, the updating and refining of the Office of Saline Water's "Standardized Procedure for Estimating Costs of Saline Water Conversion"; and consideration of development of a sister procedure for estimating costs of providing existing and incremental water supplies from conventional sources. The objectives and problems involved in the long-range program currently are being discussed with a great number of universities, research organizations, consultants, and industrial groups.

Processes Development

Applied research is being conducted to solve a number of problems in order to more fully develop existing conversion processes as well as to carry out further development of the new conversion techniques resulting from the basic research program. Under the processes development program, pilot plant and other studies were conducted on the distillation, electrodialysis, and freezing processes prior to their selection for the five demonstration plants. Efforts to reduce the cost of the conversion methods have been pursued through two fundamental approaches; namely, the reduction of capital equipment and associated costs, on the one hand, and reduction of energy requirements, on the other. Optimization of these and other operational factors have been important in the overall cost of conversion. Process development has been conducted with emphasis on the major process groups of distillation, membranes, freezing, and a general category of other chemical, electrical, or physical conversion methods. The research and development is being conducted by means of pilot-plant operations, testing of prototype units, and a variety of applied research related to the various processes.

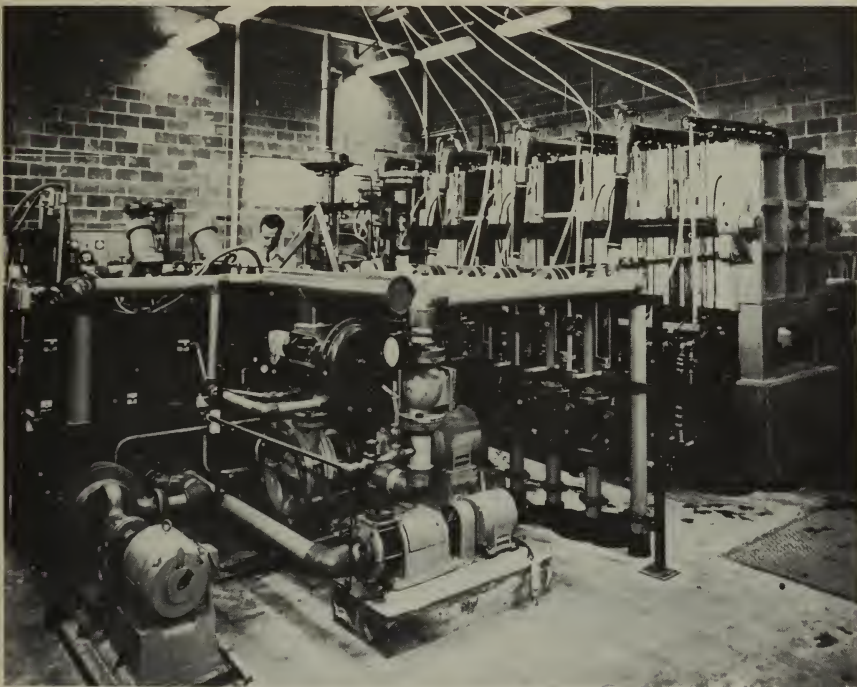
Pilot Plants Test Station

Facilities for future pilot-plant operations are being greatly enhanced through the construction of a Research and Development Pilot Plants Test Station at Wrightsville Beach, N.C. Bids were opened on April 24, 1962, and a contract was awarded to the Potts-Brown Co. of Charlotte, N.C., for the construction of the facility at a cost of \$825,000.

The land for the facility was donated to the Department of the Interior by the State of North Carolina. Completion of the facility is scheduled for December 1962. The facility will allow operation of various types of pilot plants under standard conditions.

Scale Control

Distillation processes provide the principal commercial method for obtaining fresh water from sea water, and it is estimated that land-based installations provide 20 million gallons of fresh water daily from sea water. Although distillation processes have been under development for longer than other methods, their full potential is yet to be realized. Characteristic of the distillation field is the wide variety of designs and cycles employed. Scale formation has long been a problem with distillation units as well as most other methods. Although various procedures have in the past been employed to prevent scale, and others are now under development, the effects on the process efficiency and design are of such importance as to make necessary the



General view of the electrodialysis equipment used to desalt 250,000 gallons of fresh water per day at the Webster, S. Dak., saline water conversion demonstration plant. This plant was completed and placed in operation on October 20, 1961.

continued development of improved scale-prevention methods. Effective and economical means of scale control will not only overcome reduced heat transfer resulting from scale but will also permit greater economy and efficiency through higher temperature operation and higher brine concentrations.

Control of both calcium sulfate and alkaline scales through internal stabilization or sludge recirculation has been conducted with a forced circulation evaporator, an experimental multiple-stage flash evaporator, and the modified pilot-plant equipment used originally for the LTV process. In addition to sludge recirculation, the use of additives (Hagevap and related substances) for scale prevention is also under study. Another approach to scale prevention is the use of an ion exchange softening procedure in which the waste brine concentrate serves to regenerate the ion exchange resin. The development of these procedures has progressed to the point where both ion exchange softening and sludge recirculation are being incorporated as alternate methods for scale prevention in the Roswell, N. Mex., demonstration plant.

Heat Transfer

Much of the new research is being directed toward methods which will materially increase the heat transfer in the evaporators. The use of thin films to transfer the heat and provide an evaporating surface is being investigated in detail. In the thin film developments, a 37,000-gallon-per-day (gpd) pilot plant is now under construction to evaluate the wiped film evaporator concept. A detailed evaluation is also being made of the use of a thin film on a fluted surface either in tube or sheet form.

The vapor reheat process in which there are no metallic heat transfer barriers has reached the pilot-plant stage and a unit of 4,600 gpd is currently under construction.

A thermodynamic and economic evaluation is in progress on the merits of the use of a secondary heat transfer media. The effects of geometry on the design of multiple-stage flash distillation units are under study.

Solar Distillation

The operation of experimental types of solar stills at the Daytona site has resulted in the design and installation of an improved type of basin solar still which uses only concrete, glass, and asphalt in its construction. Simplicity of design in this 3,000-square-foot still gave a major reduction in the cost per square foot. The materials used are expected to give very long life with minimum maintenance. Test operations during the past year have been very satisfactory.

Solar distillation, which is basically a humidification process, has led to other studies of humidification as a conversion method operating either with a solar heat source or a conventional fuel source. For these humidification designs, heat recovery systems are employed analogous to heat recovery in multiple-effect flash distillation.

Membrane Processes

Research and development is continuing on membrane processes with particular emphasis on electrodialysis which is further advanced than the other membrane processes and is especially important in the conversion of brackish waters. A major part of the effort in electrodialysis has been the development program being supported by the Office of Saline Water at the Bureau of Reclamation Laboratories in Denver, Colo. A general program of electrodialysis process studies has been continued in which evaluation of commercial cells and membranes have played an important part. Five different commercial units and as many membranes have been evaluated.



More than 4,000 people gathered on March 10, 1962, for the dedication ceremony of the 1-million-gallon-per-day saline water conversion demonstration plant on Point Loma, near San Diego, Calif.

A brackish water well near Denver has been utilized to supplement laboratory tests. The preparation of a manual for the laboratory characterization of membranes is nearing completion. The processes development studies at Denver have also provided assistance to the electro dialysis demonstration plant at Webster, S. Dak.

Freezing

Two different freezing processes are being investigated by the Office of Saline Water at pilot-plant level. The first utilizes the principle of flash evaporation of precooled sea water with the subsequent absorption of the water vapor by a chemical absorbent. The resulting ice is separated from the saline liquor and washed free of adhering salt and then melted by utilizing the heat of absorption. A 15,000-gpd pilot plant has been operated throughout the year at Wrightsville Beach, N.C. Operation of the unit has been very satisfactory and the technical feasibility has been fully demonstrated.

The other freezing method is based on a system in which the precooled sea water is frozen by flashing a hydrocarbon refrigerant (butane) in direct contact with the feed stream. The ice crystals are washed free of salt and melted by condensation of the refrigerant vapor. A 35,000-gpd pilot plant has been in operation at St. Petersburg, Fla. The technical feasibility of the method has been established and both systems have been included in the specifications for the fifth demonstration plant which is to be a freezing plant of 250,000-gpd capacity to be located at Wrightsville Beach, N.C.

A modification of the process using a refrigerant in direct contact with the saline feed water is also under study. This involves special procedures to induce large crystal growth to enable washing and separation by either vacuum filtration or centrifugation. A 15,000-gpd pilot plant is now being designed and constructed.

Hydrate Process

The hydrate process is one of the newer processes approaching the pilot-plant stage. Research on the process has reached the point where further verification on a pilot-plant scale is warranted. At present a 10,000-gpd pilot unit is being designed, with construction of the plant to follow. Although various materials form hydrates, hydrocarbons have suitable properties for this purpose and propane has been utilized in the research. In operation the propane combines with the water to form an insoluble hydrate. The hydrate is washed free of the salt water, decomposed by melting, and the product water and propane separated. The propane functions both as a constituent of the hydrate and as a direct refrigerant. Hence, the hydrate crystals

are melted and decomposed by the condensing propane in a cycle analogous to the freezing system using a direct contact refrigerant.

Solvent Extraction

The application of liquid-liquid extraction as a means of desalting saline waters has been shown not only to be theoretically possible but in practice to offer advantages in the conversion of certain types of brackish waters in the range from 5,000 to 10,000 ppm. Liquid-liquid extraction is based on the principle that fresh water may be extracted from salt solutions by a solvent as a mixture of solvents that is capable of dissolving salt-free water without losing the identity of the solvent as a separate phase and thus releasing the fresh water by a moderate increase in temperature. Consideration is being given to construction of a pilot plant of 2,000-gpd capacity during the coming year.

Demonstration Plants

The five demonstration plants authorized under Public Law 85-883 are programed as follows:

Long tube vertical multiple-effect distillation.....	Freeport, Tex.
Multistage flash distillation.....	San Diego, Calif.
Electrodialysis.....	Webster, S. Dak.
Forced circulation.....	Roswell, N. Mex.
Freeze demineralization.....	Wrightsville Beach, N.C.

After being placed in operation during the spring of 1961, the 1-million-gallon-per-day saline water conversion demonstration plant at Freeport, Tex., was subjected to the full fury of the driving winds and floodtides of Hurricane Carla. Over 6 feet of sea water engulfed the plant, ruining all instruments and electrical gear as well as inflicting other damage. However, in spite of the extensive damage, the plant was back in operation 4 days after the waters subsided, providing a needed source of water, free of silt and contamination, for the city and industry of Freeport. The plant has been in almost constant operation since that time. Initial estimates of the cost of the fresh water produced by the plant are in the range of \$1-\$1.25 per thousand gallons.

The 250,000-gallon-per-day demonstration plant designed to desalt the brackish well water of Webster, S. Dak., was completed and placed in operation on October 20, 1961. The plant utilizes a membrane process to reduce the salinity of the Webster well water from approximately 1,800 dissolved parts of salt per million parts of water (ppm) to less than 275 ppm.



Aerial view of the 1-million-gallon-per-day saline water conversion plant on Point Loma, near San Diego, Calif. This plant was completed and placed in operation on March 10, 1962.

A third demonstration plant, located on Point Loma near San Diego, Calif., was officially accepted by the Government on March 10, at a ceremony attended by over 4,000 people. This plant uses a multistage flash distillation process to produce 1 million gallons of fresh water per day. Shortly after the plant began producing fresh water, a major operating problem was encountered. The difficulty

did not involve the operation of the conversion process, but rather the sea water intake system. An inordinate amount of seaweed hampered the efficient operation of the intake system. A number of improvements to the intake screens corrected the situation and the plant is operating at or above designed capacity.

Specifications were issued and bids accepted for the demonstration plant to be constructed at Roswell, N. Mex. A \$1,794,000 construction contract was awarded to the Chicago Bridge & Iron Co. The plant is scheduled to be completed and in operation in July 1963. Specifications were also completed and issued for the Wrightsville Beach, N.C., demonstration plant.

The Demonstration Plants Division staff assisted the Columbian Government in selecting an architect-engineer for the purpose of developing specifications for a proposed combination power and sea water conversion plant for the island of San Andres in the Caribbean.

Office of the Assistant Secretary Fish and Wildlife Service

Frank P. Briggs, *Assistant Secretary*

Acting for the Secretary of the Interior on Fish and Wildlife matters and directing policies of the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife, the Assistant Secretary for Fish and Wildlife is deeply concerned with international as well as national conservation problems.

The Department of the Interior's Fish and Wildlife Service, two bureaus—Sport Fisheries and Wildlife and Commercial Fisheries—each with a director and executive staffs, are responsible for migratory birds with all their problems, and commercial fisheries with similar fields of concern force the Assistant Secretary into international fields. At the national level, his Office is responsible for direction of research, laboratories, wildlife refuges, and fish hatcheries.

The Commissioner for Fish and Wildlife Service supervises the day-to-day operation and direction of the Fish and Wildlife Service programs and works closely with the Assistant Secretary in setting up plans, goals, and policies.

Our renewable national wealth is capable of being maintained and greatly improved by proper management, but equally possible of destruction if unwisely exploited. Properly managed, our resources can provide food and employment, directly and indirectly. The training and recreation afforded by these resources strengthen national defense by contributing to the general health and physical fitness of millions of citizens and the existence of seaworthy ships with trained crews is a direct national asset.

The trend toward greater interest in the sea and a greater utilization of its products has accelerated, with many nations increasing the size and efficiency of their fishing fleets and with new national flags appearing on the fishing areas of the high seas. A new interest in the sea has been exhibited by many countries, and the concerted research activities of many American agencies stress the importance of oceanography in meeting and solving resource conservation problems.

The trend also is for more utilization of outdoor areas by those who want to hunt and fish and those who want to hike and look while the developing Nation absorbs more and more of the outdoor areas which were once available for recreation and wildlife habitat.

In brief, the activities of the Fish and Wildlife Service consist of meeting international fish and waterfowl problems through international commissions, treaties, and conservation; in extensive research on both sport and food fish in laboratories, lakes, streams, and on the high seas; by management of the migratory game bird resources and by the operation of a huge national wildlife refuge and national fish hatchery system; by the management of the great fur-seal resources; by research on various wildlife problems, including studies on genetics, disease, the effects of pesticides on fish and wildlife, methods to control pest and predators without damage to trees, bird-banding studies, breeding and wintering ground studies, techniques for measuring waterfowl production, and numerous other activities; exploratory fishing and gear improvement programs to help the American fisherman in his competitive relationship with the fishermen of other nations; intensive study to get the most and best nutritive value from sea products; and so on through an almost endless roster of activities.

Fish and Wildlife Service

Clarence F. Pautzke, *Commissioner*



A major problem facing the Nation is adjusting its fish and wildlife resources to the changing combinations of land and water and in meeting the challenge of developing the food potential of the lakes and oceans.

The vast Fish and Wildlife Service program designed to consolidate our fish and wildlife resources with the changing face of the country and to help the seas supply their quota of food for the increasing population is conducted under the general supervision of the Commissioner of Fish and Wildlife, who is, in turn, responsible to the Assistant Secretary of the Interior for Fish and Wildlife.

Under the Commissioner are two operating arms—the Bureau of Commercial Fisheries and the Bureau of Sport Fisheries and Wildlife. Each Bureau operates in a distinct field, although in some instances their programs and operations are on parallel or similar courses. In those instances, the task of coordination is added to the directional responsibilities of the Commissioner.

The conservation program conducted by the Fish and Wildlife Service of the Department of the Interior is both national and international in character. The Service is linked or allied with numerous interstate programs and is directly concerned with 12 international conventions or commissions.

The Commissioner has two areas of responsibility in relation to international conservation. In some instances, he is a member of an international commission by Presidential appointment; in others, his responsibility stems from the relationship of the international commission to the activities of one of the component bureaus.

The Commissioner and personnel of the two bureaus are members of, or participate actively in, international commissions and operate under international conventions dealing with fur seals, Pacific halibut, Pacific salmon, whales, Indo-Pacific fishery research, Northwest Atlantic fisheries, tropical tuna, North Pacific fisheries, Great Lakes fisheries, shrimp, and two migratory bird treaties.

A member of the Commissioner's staff served on the U.S. delegation, as a representative of the fish and wildlife conservation interests, to the International Conference on Prevention of Pollution of the Sea by Oil in London, England, in March and April 1962, attended by representatives of 56 nations and 8 international organizations. This Conference was convened to consider amendments to improve and strengthen the 1954 convention which the United States ratified in 1961. The Commissioner's staff member also served on the national committee dealing with this problem prior to the Conference, and assisted with the first national survey of the effects of oil pollution on our fish and wildlife resources.

Owing to the great expansion of fishing activities on the high seas during the past year, there is a growing need for effective international cooperation. The Office of International Relations, through which many matters of policy and routine flow in connection with the international commissions, is under the direct supervision of the Commissioner. This Office also supervised the Service's continued cooperation with the Agency for International Development in providing technical assistance to friendly foreign countries in the development of their resources. A notable feature of the past year has been the great interest in training African technicians in the development and conservation of the magnificent wildlife resources of that continent. Also, there is a growing recognition of the need for greater use of the large marine and inland fishery resources of Africa.

The Commissioner's contact with Bureau operations on both the national and international level is through the directors of each of the two bureaus and through the Office of Program Review which performs staff functions for the Commissioner. One of these is the sponsoring and coordinating of an active safety program in the component bureaus of the Fish and Wildlife Service to reduce work injuries, property damage, motor vehicle accidents, fires, tort claims, and accidents to the public who use Service-administered facilities. Field activities of both bureaus aggressively participated. Direct costs of work injuries, resulting time lost from the job, and the cost of property damaged through accidents showed substantial reductions.

Secretary of the Interior Stewart L. Udall personally presented the Department's Annual Fleet Safety Award to the Bureau of Sport Fisheries and Wildlife for the best motor vehicle accident record in the Department—an outstanding 1.9 reportable accidents per 1 million miles of driving. The increasing use of Service facilities for public recreation presents a growing public safety problem.

The Commissioner also has general responsibility for acquainting the public with progress being made in carrying out his responsibilities of consolidating fish and wildlife resources with changing conditions. Much of this task is done by another staff unit, the Office of Information, which in the last half of the year launched an expanded program of public education concerning the work and significant contributions of the Fish and Wildlife Service.

The first of a series of large posters, designed as educational aids for general use by personnel of both bureaus and for schools, field installations of each bureau, and other interested groups, was completed and was received enthusiastically. This first poster illustrates the work of the Fish and Wildlife Service—"Research and Management for Food and Recreation." The series as planned will eventually consist of 20 posters showing different phases of the work of each bureau and their relation to the overall program of fish and wildlife conservation.

A new *Something About* series was initiated for correspondence aids in answering the thousands of inquiries received from the young citizens of today who will be the conservation leaders of tomorrow. These new aids deal with subjects that have been found to be of particular interest to these young people and are written in nontechnical, easily understood language for their benefit. A collection of *Conservation Thoughts* also have been published in the form of small illustrated placards, suitable for framing or for school bulletin boards.

Attractive folders were designed and produced for use in distributing Bureau of Sport Fisheries and Wildlife conservation literature in kits at public meetings, teachers' conferences, and similar functions. Exhibits were also provided at many such meetings throughout the country during the year.

The Office of Information cooperated with the national organization of 4-H Clubs of America in producing a 4-H Club leader's handbook on conservation which is to be made available during the coming year.

The Office of Information's staff wildlife artist made a major contribution to the Department of the Interior exhibit at the President's White House Conference on Conservation. His oil painting picturing the recreational values of the great outdoors was the "centerpiece" of the exhibit.

Special duck hunting conservation education efforts during the hunting season included a television short, special poster, and newspaper cartoon to carry the theme of "Shoot Only Drakes—Spare the Hens To Nest Next Year" to the duck hunters. To help hunters and others learn how to identify ducks to protect the birds in short supply, a 14-minute film in sound and color, "Know Your Ducks," was completed and put into circulation.

Bureau of Sport Fisheries and Wildlife

Daniel H. Janzen, *Director*



The continued decline of the continental waterfowl population and the accelerating encroachment of civilization upon fish and wildlife habitat emphasize the importance of the national wildlife refuge system and the national wildlife management and research programs conducted by the Fish and Wildlife Service's Bureau of Sport Fisheries and Wildlife.

Additional impetus to the Department of the Interior's sports fisheries and wildlife program was given by the passage of important conservation legislation and by the endorsement of the Bureau's land acquisition program by the Outdoor Recreation Resources Review Commission in its report to the President and the Congress.

The most significant of these wildlife conservation laws enacted during the year was the Wetlands Loan Act authorizing an advance of \$105 million over a 7-year period to accelerate the Bureau's land acquisition program. This will permit the Bureau to make considerable progress in perpetuating the waterfowl resource.

A reservoir research program which the Bureau inaugurated during the year is designed to get the information necessary to keep America's large manmade lakes up to their maximum fishing potential. Only a portion of this potential is being utilized now. These artificial lakes cover more area than all the natural inland lakes and ponds in the country and provide one-fourth of the Nation's fishing. As population increases and as the potential of these lakes develops, a much higher percentage of the fishermen will seek recreation on these inland waters. Reservoir research centers were established during the year in Arkansas and South Dakota to study the fishery problems of impounded waters.

Attention is called also to another phase of conservation—the enforcement of conservation laws. During the 10-year period ending in 1962, 365 individuals have been arrested for that wanton destruction of waterfowl known as market hunting, and thousands of others have been apprehended for less disastrous violations. But the wholesale arrests by Bureau personnel clearly show that although market hunting was outlawed 62 years ago it continues to exist and must be constantly curbed.

Managing Wildlife and Sport Fishery Resources

As other nesting, resting, and feeding areas are lost through drainage, drought, and urbanization, ever greater attention must be directed toward the fullest possible use of the national wildlife refuges by wildlife. Techniques to increase the wildlife use of the refuges continue to be developed. Controlled water manipulation and reduction of predator species have resulted in marked waterfowl production on refuge areas, notably the Monte Vista refuge, Colorado, and the Agassiz refuge, Minnesota.



The Canada goose nests on more than 60 national refuges.

For more than 25 years, this Bureau has been striving to reestablish the Canada goose as a migrant the full length of the Mississippi Flyway. For many years wintering concentrations were found no farther south than Horseshoe Lake in southern Illinois. Now, concentrations of Canada geese have been brought southward along the east side of the Mississippi River to the Yazoo refuge, Mississippi, within 250 miles of the gulf coast. On the west side of the river, these geese are reestablished as migrants to the White River refuge in east-central Arkansas, about 325 miles from the gulf coast. Under the new wetlands acquisition program, it should be possible to fill in the remaining gaps of the flyway in Arkansas, Louisiana, and Mississippi, as well as to add some crop and grazing lands to the important Lacassine and Sabine refuges, where major wintering concentrations of Canada geese occurred in earlier years.

Federal refuges provided a billion and a quarter use-days by waterfowl during the past fiscal year.

Accelerated Land Acquisition Program

Since fiscal year 1961 all proceeds from the sale of duck stamps (except expenses incurred by the Post Office Department in connection with sales) have been earmarked for the location and acquisition of lands for waterfowl use. During fiscal year 1962, funds were obligated for the acquisition of 18,590 acres of land for refuge purposes. These lands, in 16 separate units, are located in 14 States. In addition, funds were obligated for 16,650 acres of small wetlands for waterfowl production purposes in the States of North and South Dakota and Minnesota. Of this total, 11,682 acres were acquired in fee and 4,968 acres by easements to preserve the existing waterfowl nesting habitat.

The Congress has recognized the inadequacy of duck stamp funds to acquire, while still available, the wetlands and other waterfowl habitat needed to preserve the waterfowl resource. The Wetlands Loan Act of October 4, 1961, authorized the appropriation of not to exceed \$105 million for the 7-year period beginning with fiscal year 1962. These moneys are a loan to be repaid to the U.S. Treasury from duck stamp receipts at the rate of 75 percent of the annual duck stamp receipts beginning with fiscal year 1969. The Congress appropriated no moneys under this authorization for fiscal year 1962, but has appropriated \$7 million for fiscal year 1963.

Wetlands Program Defined

With congressional authorization for the appropriation of \$105 million for a 7-year period, the Department of the Interior will take

a major step toward reaching its goal of 4.5 million additional acres of wetlands under Federal control. The Department's 7-year program contemplates acquisition of approximately 2,950,000 acres of land—about two-thirds of the ultimate goal of 4.5 million acres. Of this total, about 1,200,000 acres will be for new migratory waterfowl refuges or additions to existing refuges. The remaining 1,750,000 acres will be for waterfowl production areas in the Prairie States, 600,000 acres of which will be acquired in fee and 1,150,000 acres covered by easements to assure preservation of the wetlands character of the areas. The types of habitat in the 2,950,000 acres to be acquired will be about 78 percent for waterfowl breeding and nesting areas, 6 percent for resting and feeding areas during migrations, and 16 percent for wintering areas.

Approved New Waterfowl Refuge

The Migratory Bird Conservation Commission approved the acquisition of lands for five new waterfowl refuge projects. The proposed Anahuac National Wildlife Refuge, in southeastern Texas on Galveston Bay with an eventual area of 9,907 acres, will preserve an important segment of brackish marshes vital to waterfowl populations in the Central Flyway and provide a partial replacement for their fast disappearing wintering habitat. The proposed Alamosa refuge, in the San Luis Valley of south-central Colorado with an eventual acreage of 9,429, will provide an important waterfowl migration, production, and wintering area in an area where waterfowl habitat is being rapidly destroyed.

The Davis Island refuge, in Mississippi on the Mississippi River near Vicksburg, will contain about 26,000 acres when completed. It will serve as a resting, feeding, and wintering site for ducks as well as help to reestablish the southward flight pattern of the Canada goose in an area where destruction of valuable waterfowl habitat is continuing. The proposed Delevan refuge, of 5,664 acres in the Sacramento Valley of California, will help meet the paramount need for waterfowl wintering areas in the Pacific Flyway by providing additional feeding and resting acreage to attract and hold large numbers of waterfowl during critical periods.

The proposed Eastern Neck Refuge on the Eastern Shore of Maryland, with an eventual acreage of 2,071, will meet the need for a refuge in this part of the Atlantic Flyway by providing feeding areas for ducks and geese. It will be of major importance to the hard-pressed diving ducks. The Commission also approved the addition of 9,389 acres of land to seven existing national refuges in seven States.

Four National Refuges Established

Four new national wildlife refuges were established during the year. The Ottawa refuge, Ohio, on purchased land on the shore of Lake Erie near Toledo, contains some of the best remaining waterfowl habitat in Ohio and will insure maintenance of marshes essential to waterfowl. The Wyandotte refuge, Michigan, established by congressional action on small islands of the public domain in the Detroit River, is in one of the most important concentration points in the Nation for diving ducks and is an important feeding ground for black ducks.

The Davis Island refuge, Mississippi, is considered a primary wetland area of particular importance to waterfowl. The refuge was established during fiscal year 1962 by the withdrawal and reservation of 70 acres of public domain. It eventually will contain approximately 26,000 acres, as approved by the Migratory Bird Conservation Commission. The Harris Neck refuge, Georgia, of 2,687 acres in McIntosh County, a former Army airfield acquired from General Services Administration, will serve as a feeding, resting, and wintering ground for migratory waterfowl, especially Canada geese, and its establishment is another step in providing an adequate chain of refuges along the eastern seaboard.

Fifteen National Refuges Activated

The following national wildlife refuges have been staffed and placed under active administration since January 1961:

Modoc refuge, California, 6,050 acres, is in an area where chanelization of portions of a river and agricultural land-drainage operations had materially reduced former waterfowl habitat. Pixley refuge, California, 4,244 acres, and Kern refuge, California, 10,544 acres, near the southern end of the Central Valley, are jointly administered. These refuges will be valuable feeding areas for wintering waterfowl. Klamath Forest refuge, Oregon, 20,358 acres, is an important waterfowl production area, especially for diving ducks. Fish Springs refuge, Utah, 17,872 acres, is a natural nesting area for waterfowl and shorebirds, but in recent years water diversions caused large areas of the marsh to become dry.

Ouray refuge, Utah, 7,498 acres, will provide a much-needed production and management area to preserve the Great Basin Canada goose, native to Wyoming and eastern Utah. Benton Lake refuge, Montana, 12,383 acres, established in November 1929 by Executive order on public domain had remained undeveloped, awaiting an insured water supply, which is now completed. It had been an important waterfowl breeding area for both the Central and Pacific

Flyways and served as a feeding and resting area for waterfowl during spring and fall migrations. Pocasse refuge, South Dakota, 6,000 acres, lies directly on the Missouri River flight lane and will attract a large number of migrant ducks and geese. It is in a latitude sufficiently north to ensure the retention of breeding birds.

DeSoto refuge, Iowa and Nebraska, 6,994 acres, on both sides of the Missouri River, will restore waterfowl resting and feeding habitat. The area is also being developed for summer recreational use. Washita refuge, Oklahoma, 17,680 acres, is on the Foss Reservoir developed by the Bureau of Reclamation. Wapanocca refuge, Arkansas, 7,940 acres, one of the last wetland areas in the Memphis, Tenn., region, will serve as an excellent "stepping stone" for geese and ducks in their migration along the Mississippi River. Catahoula refuge, Louisiana, 5,308 acres, was established October 1958. Its waterfowl habitat had largely been destroyed by oil pollution and waterfowl use of the area had declined markedly. Management of this important refuge will encourage the return of greater numbers of ducks and geese to the area and the Mississippi Flyway.

Choctaw refuge, Alabama, 4,250 acres, was established in cooperation with the Corps of Engineers and the State of Alabama on the backwaters formed by the Jackson lock and dam. It will mitigate losses to wildlife resources and recreation from the flooding of valuable bottom-land environments by construction of the dam. Mackay Island refuge, North Carolina and Virginia, 7,856 acres, in the heart of the famous Back Bay-Currituck Sound waterfowl area, attracts the largest wintering concentration of greater snow geese remaining in North America. Erie refuge, Pennsylvania, 2,727 acres, first Federal refuge in Pennsylvania, lies in the westerly portion of the Atlantic Flyway and is used by ducks and geese migrating from the Hudson Bay area to the Atlantic coastal marshes.

Preserving Fishery Resources of Inland Waters

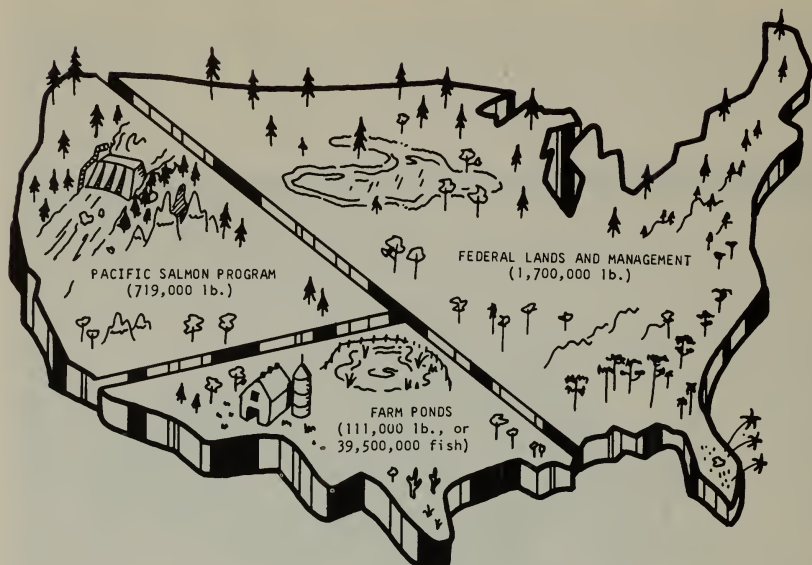
For almost 90 years the U.S. Government has been directly associated with efforts to preserve the fishery resource of the Nation's inland waters. Today, within the national fish hatchery system, more than 100 stations produce the fish species required to help maintain this resource. Efforts of the Bureau of Sport Fisheries and Wildlife are concentrated on providing fish to stock waters on lands under Federal ownership or control, to assist the States in stocking public waters, and to make fish available for initial or replacement stocking in farm and ranch ponds. The ultimate goal of these efforts to preserve and enhance the fishery resource is to make available the greatest possible recreational opportunities for the American public.



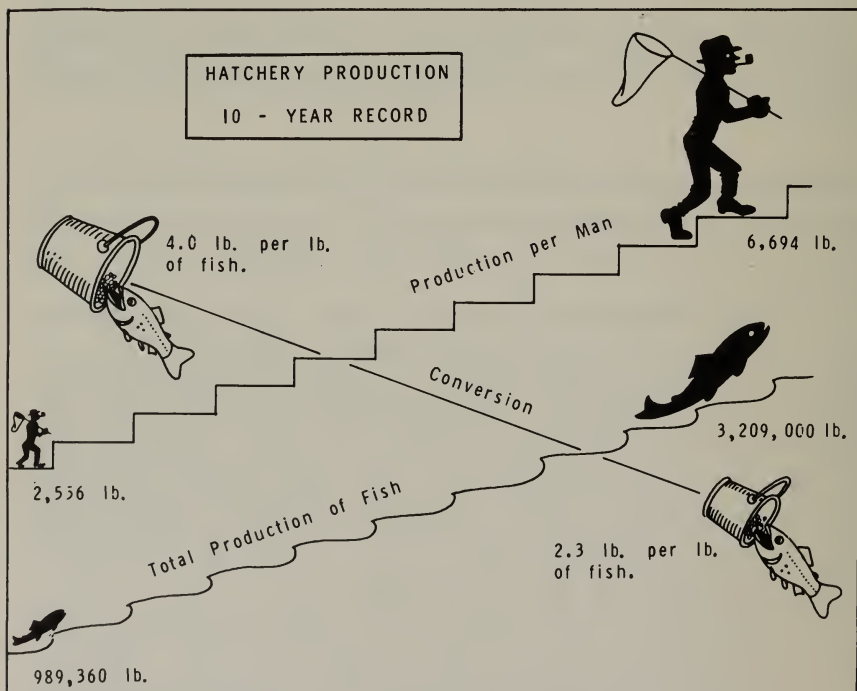
A typical fish distribution unit of the Bureau of Sport Fisheries and Wildlife. During fiscal year 1962, some 215 million fish were distributed from national fish hatcheries.

Production of fish must be coordinated with biological and management investigations and related ecological, environmental, and other research studies in order to realize the maximum benefits from hatchery-produced fish. Thus, a coordinated effort on the part of various components of the Bureau, as well as the cooperation of other Federal and State agencies, is required. The production, rearing, and distribution of these fishes is the direct responsibility of the Branch of Fish Hatcheries. In carrying out that responsibility, the Branch established three new records in the past production year: The highest average production per man, 6,694 pounds of fish; the best conversion rate on record, 2.3 pounds of food to 1 pound of fish; and the highest total production, 3,209,110 pounds of all species—a 17-percent increase over the previous year.

While significant advances were being made in fish production, various management or operational improvements were realized in other segments of the national fish hatchery program. Three in-service training schools continued to provide advanced training in fish



DISTRIBUTION OF FISH PRODUCED AT NATIONAL FISH HATCHERIES



nutrition, fish pathology, and fish-cultural techniques. To date, a total of 186 Federal employees, principally from the Federal fish hatcheries, have successfully completed training at these schools. This program is a vital part of an overall effort, including recruitment of increased numbers of college graduates and expanded use of the student trainee program, to improve the caliber of the profession of fish culture.

In addition, greater use was made of mechanized or specialized equipment to reduce or eliminate time-consuming jobs and to enhance fish-cultural practices; efforts were directed to improve dietary controls, while better foods and feeding techniques reduced fish production costs; special attention was given to improvement of brood stocks which has resulted in healthier, gamier fish; and programs such as the recently initiated internal publication, *The Dorsal Fin*, assist in widening the scope of communications throughout the national fish hatchery system. Continuing investigations relating to the problem of trout hepatoma were conducted on several national fish hatcheries. Progress to date has produced valuable information on dietary aspects of trout production.

New Fish Hatcheries Under Construction

In fiscal year 1962, Congress provided funds to begin construction of four new national fish hatcheries at Greers Ferry Dam, Ark., Jordan River, Mich., Lahontan, Nev., and Wytheville, Va. Additional funds were appropriated to continue construction of three other hatcheries authorized in recent years: Alchesay, Ariz., Garrison Dam, N. Dak., and Gavins Point, S. Dak. These stations will make significant contributions. The potential annual production from these seven hatcheries alone is estimated to be 100,000 pounds of lake trout; 495,000 pounds of brook, brown, and rainbow trout; and about 14 million warm-water fish, including northern pike, walleye, bass, bluegill, and channel catfish. In addition to the construction of these new hatcheries, funds were also provided for repair, modernization, or expansion of 12 existing hatcheries.

Fish and Wildlife Restoration

Under the Federal programs to assist the States to restore their fish and wildlife populations, each State and territorial fish and game department receives a portion of the funds collected through Federal excise taxes on sporting arms, ammunition, and fishing tackle. The amount available to a State is determined by formulae based on relative area; that is, the ratio of State area to that of the United



Water analysis plays an important role in modern fish-cultural operations. At the Lyman, Miss., National Fish Hatchery 4 million warm-water fish—bass, bluegill, redear sunfish, and channel catfish, are produced annually. These fish are stocked in farm ponds and other impoundments in Mississippi and Louisiana.

States, and the number of paid fishing and hunting license holders in the State. State agencies select, initiate, and—after Federal approval—complete work on research, land acquisition, or development projects. The State may later be reimbursed up to 75 percent of the total cost by the Federal Government.

Funds available for fish restoration since January 1961 totaled \$7,985,000, and moneys apportioned for wildlife restoration, \$24,089,298. These figures include all funds made available during fiscal year 1962 and a partial apportionment for fiscal year 1963. Obligations for fish restoration were 45 percent for research, 36 percent for habitat development, 13 percent for land acquisition, and 6 percent for administration. Comparable percentages for wildlife projects were for research, 26 percent; development, 51 percent; land purchase or lease, 17 percent; and administration, 6 percent.

The wildlife program has been in operation for 25 years and the fisheries program for 11 years. Emphasis on wildlife research has

declined as essential management data were gathered and put to use. There has been a concurrent increase in obligations for land purchase and development. Research still constitutes the major expenditure of the fisheries program. Lands actually acquired under both programs for fiscal year 1961 totaled more than 147,000 acres. Land project obligations for 1962 were comparable to those for the previous year. Thus since July 1960 about a quarter million acres of fish and wildlife lands have come under State ownership through the Federal aid programs.

Continental Scope of Migratory Game Bird Studies

Migratory game bird surveys, inventories, and banding projects are conducted throughout the United States, Canada, and Mexico for the purpose of gathering current information on the status of the resource. The gathering, evaluation, and application of these data are basic to the annual migratory bird hunting regulations. In cooperation with the State game departments, Canadian Wildlife Service, Provincial game departments, Wildlife Management Institute and Ducks Unlimited, the Bureau makes intensive aerial and ground surveys of migratory waterfowl on the Canadian breeding grounds to determine population trends, effects of hunting pressure, causes of mortality, and other data essential to management of the resource. Extensive banding programs are carried out in Canada and the United States to clarify the routes taken by game birds from their breeding grounds to the flyways and to determine the annual mortality. Winter inventories are conducted throughout the United States and Mexico to determine the population of migratory game birds following the hunting season. The continental scope of this activity testifies to its importance. There are no more intensive or extensive wildlife surveys in the world than those conducted on this continent, and the Bureau is by far the principal agency involved in the program.

Surveys of dove populations, as well as woodcock, jacksnipe, rails, and gallinules have not been conducted on the same scale as waterfowl. The importance of these species to hunter and nonhunter alike is increasing rapidly and there is more need than ever to improve the work being done in this field. Techniques for surveying these species are being developed and will soon be available for field use.

The banding of waterfowl and doves has been stepped up in the past 5 years. The Bureau is in the second 5-year cycle of waterfowl banding on the breeding grounds in Canada and the remaining work there will gradually shift to the more northern areas where transportation problems are more difficult and banding more expensive. At the same time the banding program for waterfowl in the States has



The woodcock is a popular game bird with east-coast hunters. Its habit of sitting "tight" and protective coloring complicate the censusing of its numbers.

been and will be expanded in accordance with cooperative plans made by the interested Federal and State agencies.

Enforcing Game Laws

On May 5, 1961, 45 Federal game management agents in company with State wardens arrested 161 individuals in the States of Maryland, North Carolina, Virginia, Louisiana, and Arkansas. Those arrested were charged with the illegal possession, transportation, and sale of migratory waterfowl and resident game. During fiscal year 1962, of 113 defendants brought to trial, 109 were convicted and charges against 4 were dismissed. Fines imposed by the Federal district courts ranged from \$1 to \$750, jail sentences from 2 days to 1 year, and active probation from 1 to 5 years.

Conventional enforcement activities of Federal game management agents during fiscal year 1962 resulted in the apprehension of 6,045 persons found by the agents to be in violation of Federal or State game and fish laws. In addition, Federal game management agents participated in the apprehension of 2,028 persons for violation of State wildlife conservation laws; 2,021 of these cases were terminated in State courts with \$65,543.07 in fines and costs assessed along with 2,039 days of jail sentences; \$5,640 of the fines and costs and 1,745 days of jail sentences were suspended.

The following table compares the frequency of violations of fish and wildlife conservation laws administered by the Bureau of Sport Fisheries and Wildlife in the fiscal years 1961 and 1962.

	Fiscal year 1961	Fiscal year 1962
Cases pending at beginning of year.....	715	866
New cases.....	5, 119	1 4, 017
Cases terminated:		
Declined.....	286	180
Dismissed.....	192	170
Acquitted.....	184	69
Nol pros.....		15
Won.....	4, 250	3, 757
Cases pending at end of year.....	922	657
Fines and costs:		
Suspended.....	\$8, 484. 60	\$16, 371. 95
Paid.....	\$150, 168. 04	\$112, 634. 97
Jail sentences (days):		
Suspended.....	6, 247	8, 970
Served.....	3, 335	2, 583
Probation (days).....		143, 395

¹ Includes 80 cases in which agents recommended "no prosecution."

Town-Owned Wetlands Studied

In 1961, the Fish and Wildlife Service completed its studies of town-owned wetlands along the south shore of Long Island in New York State. These studies were initiated in 1957 by the Bureau of Sport Fisheries and Wildlife in cooperation with the New York Conservation Department at the request of local town officials. The joint report of the Service and the State conservation department, released in September 1961, provides recommendations for preservation and future development of fish and wildlife resources on more than 14,000 acres of town-owned marshes and their integration with other existing and future recreational uses.

Early in 1962 an abbreviated version of the joint report was prepared by the Bureau and published as an illustrated brochure by the New York Conservation Department with the endorsement of the State's Regional Fish and Wildlife Advisory Board and its Marine Fisheries Advisory Committee. An initial printing of 20,000 copies was made available for public distribution.

Emergency Feeding of Wildlife

During the past winter, extremely heavy snowfall in several States deprived resident game birds and animals of their natural food supply. The States affected immediately took advantage of the provisions of Public Law 87-152, approved on August 17, 1961, by the 87th Congress, which authorized the States to requisition Government-owned grain for use in feeding wildlife threatened with starvation. Bureau representatives inspected the areas declared to be in need of emergency



The magnificent trumpeter swan, once so rare it was near extinction, owes its remarkable comeback to public alertness and cooperation and to a national refuge, the Red Rock Lakes refuge in Montana, established expressly for it.

feed, substantiated the situations as claimed, and assisted the States in obtaining the grain. Approximately $5\frac{1}{4}$ million pounds of Commodity Credit Corporation grains were made available to the States for wildlife feeding programs.

Thousands See Trumpeters on Loan

Trumpeter swans have now been placed in 24 public zoos and institutions located in all regions of the United States, having an estimated total attendance of more than 25 million annually. These formerly endangered waterfowl were supplied on a loan agreement in order that millions of citizens, who otherwise might never see a trumpeter except in a museum case, may now have the thrill of observing the living grace of America's largest waterfowl.

Refuge Visitors From Far Places

The number of foreign visitors has increased considerably since January 1961. Visitors to these refuges included conservation officials

from such distant points as Australia and the Belgian Congo and a number of students from African countries. Prince and Princess Yoshimaro Yamashima of Japan visited the Brigantine National Wildlife Refuge, N.J., in June. The Prince is president of the Audubon Society of Japan.

Visitors on the national wildlife refuges in 1961 showed a 3-percent increase over the visitor-days of public use in 1960. This increased recreational use, however, is below the 10-year average which has seen public use of refuges climb from 3½ million in 1951 to more than 11 million in 1961.

Storms Damage National Refuges

The location of many national wildlife refuges on or near large bodies of water poses problems of a varied nature. In September 1961, Hurricane Carla did extensive damage to the Aransas and Laguna Atascosa National Wildlife Refuges in Texas, the Sabine and Lacassine National Wildlife Refuges in Louisiana, and the Gulf Island National Wildlife Refuge in Mississippi. This hurricane added torrential rainfall and flooding on refuges in Oklahoma and Missouri. Total damage exceeded \$300,000.

The Ash Wednesday storm of March 6-8 battered east-coast refuges. A combination of hurricane-force winds and high spring tides caused damage to national wildlife refuges from New Jersey to Georgia estimated at more than \$1.5 million. Facilities, such as dikes, levees, roads, and buildings, can be replaced. The rehabilitation of habitat on these areas is most crucial, since there are no areas to take their places in providing suitable sanctuary for migrating waterfowl of the Atlantic Flyway.

Wildlife and Fishery Research

Challenges Spur Wildlife Research

Five challenging developments of growing interest to the public spurred wildlife research in 1962.

Foremost among these is recognition of the importance of outdoor recreation to people from urban areas and the contribution wildlife makes to this popular means of escape from the pressures of daily living.

Second is the recent surge in international awareness of the plight of many rare and endangered species of wildlife and the determination to find means of preventing their extinction.

Third is an awakening realization that modern civilization creates new hazards, such as radioactive fallout, pollution of our streams, and the contamination of fields and forests with the residues of pesticides. More and more people are expressing concern about the effects of these substances on wildlife as well as on human health.

A fourth is that of potential dangers to the public resulting from close association with wild animals that may be vectors of diseases. Many forms of wildlife are reservoirs for pathogens which may be transmitted to humans and domestic animals if not kept under control. These include such diseases as rabies, ornithosis, tularemia, equine encephalitis, and tick fever.

Still another development of growing magnitude is the realization that although wildlife constitutes one of our most cherished natural resources, some forms of animals can constitute a liability as well as an asset and must therefore be kept under moderate control. These five areas of concern have been impelling forces behind much of the wildlife research program during the year.

Expanded Research on Pesticide Hazards

Public awareness of hazards associated with the increased use of pesticidal chemicals is reflected in expanded research on a wide variety of insect pests. Programs for the control of grasshoppers, gypsy moths, Dutch elm disease, Japanese and white-fringed beetles, and spruce budworms are recognized as necessary. Nevertheless, they raise serious questions of how we can better control such pests without serious harm to fish and wildlife resources. Wildlife research is measuring not only the effects of currently used pest-control materials, but also is testing the effects of new compounds that show promise of greater selectivity against target species. Woodcock and robins, vulnerable because of their worm diet, and the bald eagle because of its high fish diet, may be particularly susceptible to certain of the chlorinated hydrocarbon insecticides, such as DDT, which may be concentrated in these food organisms. The goal is to encourage new pesticidal chemicals that are specific in action and to prescribe safe application techniques whereby necessary pest control can be accomplished without serious harm to fish and wildlife.

From studies on chronic effects of DDT on cutthroat trout it appears that fish do not store as high concentrations of the chemical in their body tissues as do some other forms of wildlife. Instead, the greater accumulations are found in the brain of the fish. Similar studies are underway on the effects of 2,4-D on bluegills.

Continuing investigation of the long-term effect of DDT spraying on the aquatic insect fauna of Swan Creek in Montana shows that,

although recovery takes place, the population structure changes. During 1961, field studies were conducted in connection with a number of large-scale control programs: Alabama, on tent caterpillar; South Carolina, on alligatorweed; North Carolina, on elm spanworm; Montana, on spruce budworm; Wyoming, on alfalfa weevil; and Florida, on fire ant.

New chemicals are introduced in great number and variety. It is increasingly clear that, although spectacular fish kills may occur from time to time, long-term, chronic effects may constitute the main danger. Assessment calls for painstaking and multifaceted approach: pathological examination of organs; residue analysis of tissues, of water, and of bottom materials; long-term observations of exposed fish to measure the effects on growth, health, and reproduction; and observations on the effects of chemicals on the food chain.

In the search for effective control chemicals that will do little or no harm to fish, one of three chemicals used in or proposed for fire ant control was found to be relatively nontoxic when tested on red ear sunfish.

Progress in Control of Disease Carriers

Recent research also has been concentrated on the problem of tracking down natural reservoirs and means of spread for equine encephalitis on the eastern shores of Maryland. In cooperation with technicians from the Army Medical Service, Bureau biologists have conducted studies on most wild species of the area and have tested innumerable insects to determine their role as disease vectors. While this research has not yet been completed, it has already set a standard for a similar approach to other serious wildlife-borne diseases of man and domestic animals.

Significant progress has been made in reducing the incidence of rabies in wildlife in parts of the Southeast, Midwest, and Southwest, and a new program for this purpose has been established in West Virginia.

Wildlife Damage Prevention Advances

Public demand for the control of animal damage constitutes one of the most difficult of the wildlife management problems. Many of the birds that cause serious local damage during periods of high concentration are valuable assets elsewhere. Bird hazards to aircraft range from the Laysan albatross at Midway to the gull and starling nuisance at many continental airports in the United States. Likewise, robins cause severe damage to holly groves in the West, and damage by blackbirds to rice and corn is widespread throughout many



Three tons of waterfowl taken from market hunters in North Dakota by U.S. game-law-enforcement agents. But for the market hunters, these birds would have provided many hours of enjoyment for licensed waterfowl hunters.

States. Current research on methods of control places major emphasis on prevention of damage rather than actual reduction in bird populations. During depredation control operations carried on by the Bureau, 46,300 bushels of Government-owned grain were fed to waterfowl to prevent crop damage caused by the birds.



The broadcasting of bird distress calls over mobile sound units such as this one has proved effective in dispersing large flocks of birds at city dumps and in the farmers' fields.



A mobile sound unit broadcasting bird distress calls disperses a large flock of gulls.



More than one-fourth of all contamination and loss of grain due to rodents occurs because of inadequate storage conditions on the farm.

When lethal control measures are necessary, they must be selective so that other animals will not be needlessly endangered. Such research includes the development of new and improved methods for the control of destructive mammals, chiefly in agricultural, forest, and rangeland areas. Animal damage constitutes a continuing problem, and research is necessary to provide new and better techniques that utilize the latest advances in scientific technology, ranging from the use of electronic and ultrasonic devices to new chemosterilants and anesthetic agents.

Contrary to widespread popular notions that the larger mammals, particularly the predators, are vanishing, nearly all are increasing in numbers. Texas is currently experiencing a substantial increase in coyotes and higher numbers have been noted in most of the West. Cattle losses have been severe in many areas not previously subject to heavy damage. Intensified efforts have helped to hold down losses even though overall populations of destructive animals have continued to spiral upward. Particular success has resulted from widespread use of the Bureau-developed mechanical burrow builder for controlling pocket gophers. Hitched to a tractor or farm vehicle, the

machine cuts a tunnel below the surface, intersecting natural runways and depositing measured amounts of bait. Since pocket gophers leave no open holes into their burrows, previous methods of locating their tunnels and placing bait were tedious and often unsuccessful. Use of the burrow builder has prevented major damage to agricultural crops, pastures, and reforestation projects in many parts of the Midwest and West.

The Bureau continued to participate in the clean grain program of the Food and Drug Administration. North Carolina, Kentucky, Ohio, and the Dakotas have established statewide programs with noteworthy savings in stored grain as well as reduced losses from contaminated grain being diverted or condemned.

Marine Game-Fish Research Moves Ahead

Launched in 1961 with the establishment of an Atlantic coast research center at Sandy Hook, N.J., the marine game-fish research program has made significant progress. A special statistical evaluation of salt-water angling was completed which gives for the first time the national dimensions of this sport. It shows that 6 million salt-water anglers caught 633 million fish, among which were 80 million weakfish, 42 million croakers, and 22 million flounders. The aquarium for experimental culture of marine fishes at the center has been completed. Two heavily fished species in the New York-New Jersey area—summer and winter flounders—are the first subjects for experimental studies of development and survival of young under different conditions. In the summer and early fall of 1961 the Laboratory undertook a systematic study of the distribution, abundance, species composition, and food habits of sharks and other big-game fishes from southern New York to northern Delaware.



The Atlantic Marine Game Fish Research Center, Sandy Hook, N.J.



Secretary Udall delivers dedicatory address at Sandy Hook Marine Laboratory, Atlantic Marine Game Fish Research Center, September 28, 1961.

The Sandy Hook Laboratory has also become the focal point for divers interested in conservation and underwater natural history by helping to found the American Littoral Society. Members of the society make periodic fish counts and observations of fish behavior and environmental conditions.

The new Pacific research center at Tiburon, Calif., located on San Francisco Bay in an area of extensive sport fishing for salmon, striped bass, and bottomfish, was activated. Extensive marine facilities are available at Tiburon and excellent deepwater dock and mooring bulkheads, with ample storage space and expansion potential. During the year, information was compiled on the extent, facilities, locations of fishing, and kinds of fish caught on the Pacific coast. This information has been transposed to a series of 20 charts, which will be published in atlas form.

A small but important part of the marine research program is the accumulation of life history information on important game species. It is accomplished by financing graduate studies of outstanding marine biology students on behavior, feeding, distribution, and migration. Three students are now employed in this program.



The research vessel "Cape May" was loaned to the Bureau of Sport Fisheries and Wildlife in the fall of 1961 for a systematic study of marine game fish along the Atlantic coast. Twelve Federal and State agencies and private and educational institutions interested in fishery research cooperated.

Reservoir Investigations Initiated

Public reservoirs comprise 13 million acres of water—more than all of the natural lakes and ponds in the United States—and projections indicate this vast acreage will double by the year 2000. In 1960, 96 million man-days of fishing took place on reservoirs—25 percent of the national total. By the year 2000, reservoirs are expected to absorb one-third of the total fishing effort.

Although they are constructed primarily for other purposes, the fact that reservoirs are so quickly sought out for recreation illustrates an extraordinary and increasing thirst in our expanding society for outdoor recreation on or near water. The tremendous expansion in reservoir area in the last three decades has been an unexpected bonanza in meeting these demands. These huge impoundments are

reservoirs of recreation as well as of water. Unlike natural lakes, however, successful management for fishing calls for new knowledge and skills. With their fluctuating levels, heavy sedimentation, strange patterns of flow, of chemistry, and of temperature, reservoirs pose new and unusual problems profoundly influencing the fisheries both in the impoundments and in the rivers below.

Two centers for reservoir research recently have been established: at Yankton, S. Dak., and Fayetteville, Ark. The first center will study fish populations and ecology of the main-stem reservoirs of the Missouri River in Nebraska, South Dakota, North Dakota, and Montana. Some of the largest reservoirs in the country are located here, including Fort Randall, Oahe, Garrison, and Fort Peck. The South Central Reservoir Investigations was established in the spring of 1962. This center focuses on the White River complex of reservoirs in Arkansas and Missouri: Bull Shoals, Norfolk, Table Rock, and Beaver Creek (under construction). To accelerate initiation of research, a contract was arranged with the University of Arkansas in February 1961 to make a preimpoundment study of the Beaver Creek reservoir site for comparative purposes.

Fish and Wildlife and Outdoor Recreation

The growing interest in outdoor recreation makes it necessary for the Bureau to give closer attention to the production and utilization of waterfowl and other migratory birds. To this end, the Migratory Bird Populations Station was established at the Patuxent Wildlife Research Center, Laurel, Md., in fiscal year 1962 to consolidate activities related to the analysis of band records, hunting season kill, and wing analysis for the improved management of this important resource.

Greater attention is also being devoted to measures for the protection of endangered species, which constitute only a small part of the total wildlife population but nevertheless contribute a great deal to the esthetic enjoyment of wild creatures by many nature lovers. The increased emphasis on the preservation and restoration of endangered birds is being approached through research on artificial propagation and stocking techniques. This program was given added impetus late in the year when 30 nene were received in quarantine from England on their return to Hawaii to bolster a seriously depleted natural flock. These Hawaiian geese, from the Wildlife Trust, Slimbridge, England, are living proof that a wild population can receive valuable support from hand-reared recruits. Investigations were also started



More than 14½ million hunters spent more than 192½ million days in the field, in 1960. By the year 2000, it is expected that the number of hunters in this country will more than double.

on the propagation of sandhill cranes from eggs taken from the wild. This pioneer work may be applicable to the whooping crane and other rare species after some of the preliminary problems are solved.

In certain parts of the country, particularly in the vicinity of the major Canada goose concentrations, new management measures are being used to control the harvest properly and to improve distribution of the kill and quality of the hunting. Personnel directly involved in Canada goose management programs feel that substantial progress has been made in this respect during the past 5 years by State and Federal agencies concerned.

Forest Wildlife Studied

The recreational note is sounded also in some of the forest wildlife research studies. The objective of this work is to assist the U.S. Forest Service and other land management agencies in multiple forest use by improving wildlife habitat. As a phase of this research, a Bureau biologist reviewed timber management plans of the U.S. Study Commission, Southeastern River Basins, for 55 million acres of land in four States to appraise the effects of management on wildlife and to evaluate the lands in terms of wildlife potential for meeting present and future recreational demands.

Farm Ponds Stocked

Direct recreational benefits accrue from the national fish hatchery program as it relates to the stocking of farm and ranch ponds. During the past year fish were stocked in some 47,000 farm ponds, covering more than 97,000 acres. Based on average national statistical data, these ponds will provide in excess of 3 million man-days of fishing.



Farm ponds provide many hours of healthful recreation for farm youngsters.

Technical Aid to Sport Fishing

Fishery management activities of the Bureau significantly increased recreational fishing on Federal lands and Indian reservations this year. These cooperative efforts resulted in 2.6 million man-days of fishing on 198 installations of the Department of Defense, Veterans' Administration, Forest Service, National Park Service, Indian tribes, and the Bureau's national wildlife refuges.

Looking toward greater development of sport fishing on military installations in the future, the first cooperative plan for the management and development of fish and wildlife resources on those areas, as authorized by the Congress under the "Sike" Act, has been placed in effect. It was approved for the McChord Air Force Base, Wash., May 17, 1962. Similar plans are being developed for other military areas throughout the United States, involving the Department of the Interior, the Department of Defense, and the fish and game departments of the respective States.



Opening day at a new fishing lake at Fort Benning, Ga.

A fishery cooperative unit was established at the University of Utah in January 1962. It is the first in a series of similar units to be developed by the Bureau in cooperation with the universities and the State fish and game departments to meet future demands for greater recreational fishing opportunities. The project will emphasize the training of qualified fishery workers for employment with State and Federal agencies. Research leading to improved sport fishery management will be conducted.

Sport fishing on Federal lands and Indian reservations that resulted from cooperative fishery management activities

Area	Number of installations	Days of fishing
Federal areas:		
Department of Defense:		
Air Force.....	25	113,619
Army.....	57	205,487
Navy and Marine Corps.....	22	58,308
Veterans' Administration.....	8	22,680
National forests.....	11	695,626
National parks.....	10	39,400
Wildlife refuges.....	29	1,071,798
Miscellaneous Federal areas.....	3	16,900
Indian reservations.....	33	335,193
Total.....	198	2,559,011

Future Fishing Needs Analyzed

A report, "Sport Fishing, Today and Tomorrow," was completed under contract with the Outdoor Recreation Resources Review Commission. The report concludes that over the period 1955 to 1960 the numbers of fishermen in the United States increased at the rate of 4.3 percent a year, which is 2.5 times faster than the population of the Nation is increasing. The number of fishermen is expected to increase 50 percent by 1976 and 150 percent by 2000 from the 25.3 million reported in 1960. By the year 2000, 63 million anglers will fish about 1.3 billion days. The report shows that the increased fishing demand can be met (1) by adding new waters in the form of ponds and reservoirs, (2) by better management of existing waters, and (3) by more fishing in coastal waters.



Each year sport fishing attracts more than 25 million Americans, 12 years and older, who spend collectively about 500 million days engaged in one of the Nation's most important participation sports.

National Survey of Fishing and Hunting

The second national survey of fishing and hunting in the United States was made in 1961 for the calendar year 1960. It showed that these traditional American activities are even more significant now than they were in 1955, the year covered by the first survey. The 1960 survey revealed that 50 million of the 130 million people in the Nation 12 years old and older went fishing, hunting, or both in 1960. This survey further revealed that, of the 130 million people in the United States over 12 years of age, 30 million participated in one or both sports in a substantial way and that these people spent nearly \$4 billion on these sports. This "National Survey of Fishing and Hunting" was published in September 1961. That the 25,000 copies in the initial printing are nearly exhausted attests to the value of this survey to the fish and wildlife interests of the Nation.

Impact of New Reservoir Policy

The Department of the Interior and the joint Army-Interior reservoir land acquisition policy, adopted February 22, 1962, gave impetus to the President's program, as set forth in his 1961 message on natural resources, to permit the present and future development of recreational opportunities at federally financed reservoirs.

The new policy provides for fee-title acquisition of land to the maximum flowage line rather than the relatively narrow strip acquired in fee under the previous policy, adopted in 1953. Excepted are those lands which do not have substantial value, existing or potential, for recreation or fish and wildlife purposes. The new policy also provides for fee acquisition of additional land above the maximum flowage line needed to meet the evergrowing present and future requirements for fish and wildlife development and management.

Establishment of the new policy has set in motion a review of all reservoir projects, including those already authorized but not yet constructed, reservoirs currently under construction but not yet completed, and reservoirs now in operation, to determine the measures that are needed to assure present and future needs for development and management of fish and wildlife resources. Reservoir projects presently in the planning stage are being given most careful consideration from this point of view.

Lands acquired at Corps of Engineers and Bureau of Reclamation projects in previous years that have already been made available to the States and to the Fish and Wildlife Service total nearly 2 million

acres—about 950,000 acres to the States and 934,000 acres to the Fish and Wildlife Service. Current planning at existing and proposed reservoir projects, which, of course, is subject to change in light of the new policy, contemplates an additional 780,000 acres to be made available to the Fish and Wildlife Service, primarily for waterfowl development, as part of its national wildlife refuge system.

Current planning also contemplates that a considerable acreage of land at reservoir projects will be made available to the various States for administration and management of upland game, big game, and waterfowl by the respective State game and fish departments. Most of these lands will be managed as public hunting and fishing areas. The potential for this program is not fully known at this time, but it is certain that implementation of the program will be greatly facilitated as a result of adoption of the new land-acquisition policy.

Bureau of Commercial Fisheries

Donald L. McKernan, *Director*



The responsibilities of the Fish and Wildlife Service's Bureau of Commercial Fisheries for the Nation's fishing industry include all aspects of resource management and many aspects of production and marketing which lead the Bureau into numerous fields of research and the use of results therefrom. The ultimate objectives are accomplishment of the Department of the Interior's conservation policies of wise use of the Nation's fish and shellfish resources; a prosperous fishing industry; production of a wholesome, nutritious food supply; and development and production of industrial and pharmaceutical fish products of high quality.

Fields of research include biology, population dynamics, oceanography, chemistry, food technology, economics, market statistics, electronics, engineering, exploratory fishing, and gear development.

Each field of research provides information essential for the attainment of the Bureau's objectives. Many fields of specialization in biology—embryology, histology, physiology, serology, virology, to name but a few—are used to obtain better reproduction and growth of fish and shellfish, combat diseases, and identify subdivisions of species of oceanic stocks.

Oceanography provides the explanations for the distribution and abundance of commercially valuable fishes, and with this knowledge it is possible to forecast where and in what quantities certain species of fish may be caught.

Chemistry is used to develop new and better fish products for both food and industrial uses. Food technology investigations provide new and better ways of preparing, packaging, storing, and marketing fish products.

Economic investigations supply information on all aspects of production, processing, distribution, and marketing. The methods of statistics and biometric analysis are used in studying population dynamics, and in economics and in statistical market reports.

Electronics and engineering are used primarily in guiding and passing fish around or over obstacles such as dams, and to observe behavior of fish and fishing gear. Exploratory fishing locates new stocks of commercially valuable fish and shellfish; gear research develops improvements in fishing gear.

Research and Development

Our research in the many fields of science and of harvesting fish is directed toward solving specific problems of the fishing industry. Some problems on which the Bureau has made significant progress in the past year are described briefly on the following pages.

Biological Oceanography

The Bureau of Commercial Fisheries has played a major part in developing plans for an international oceanographic and fishery research program in the equatorial Atlantic Ocean starting in January 1963. Nine other U.S. agencies will join this Bureau in a survey of the equatorial Atlantic between the Africa and South America coasts. Several foreign countries have expressed an interest in participating. A principal objective of these investigations is to obtain information that will aid in the harvest of fish to feed the people of protein-deficient countries bordering both sides of the equatorial Atlantic. Utilization of immediately available fishery resources will be an important factor in alleviating serious nutrition problems in countries which are unable to produce sufficient quantities of protein-rich foods for human consumption.

The Bureau's Biological Laboratory at Washington, D.C., is responsible for immediate supervision of the Bureau's part of the research. As presently planned, the Bureau's research vessel *Geronimo* will be one of 12 vessels engaged in the program. Two 15-day surveys will be made in the period February 15–April 3, 1963, and one in the period August 1–15, 1963. Vessel operations will be coordinated closely so that similar observations are made throughout the equatorial Atlantic during the three 15-day periods.

Although the Bureau's interest centers mainly on biological oceanography, other cooperators will be gathering data on all aspects of oceanography—physical, chemical, biological, meteorological, aero-

logical, geological, and geophysical. Future research in the equatorial Atlantic will be guided by the results of this cooperative effort.

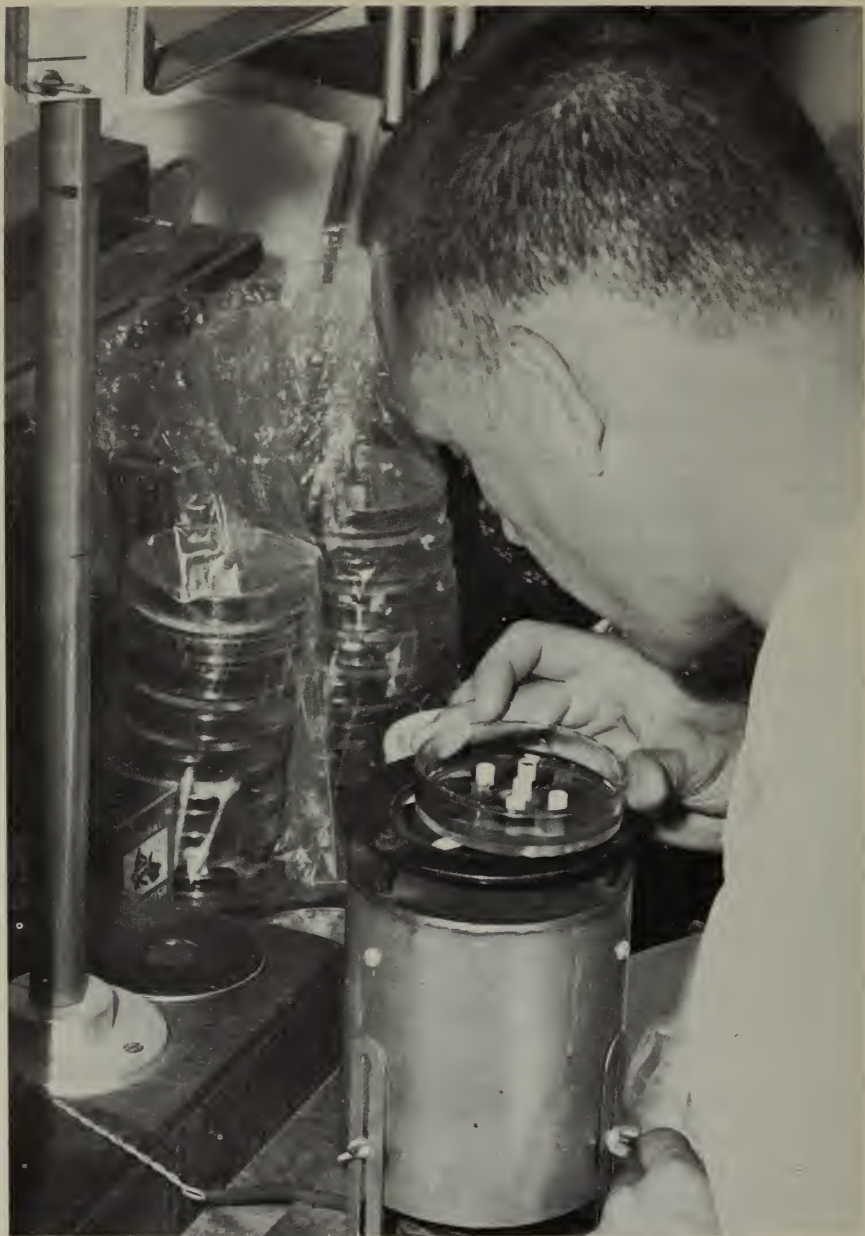
Salmon

Efforts to restore and protect valuable runs of Pacific salmon increased during the past year. A 2-year emergency research program in Alaska is nearing completion. Information necessary for successful renegotiation of the International North Pacific Fisheries Convention is the major objective. We have increased our knowledge of how many fish should be allowed to spawn in order to sustain maximum red salmon runs in Bristol Bay rivers. We have learned that red salmon spawn to a depth of 100 feet in some lakes and that the number of young salmon which a lake can support varies widely.

Our ability to predict the size of salmon runs improved with the expansion of tagging and sampling programs in the central North Pacific and Gulf of Alaska. Our first winter survey cruise located a significant concentration of immature red salmon in a broad area from 100 to 200 miles south of Kodiak Island. Red salmon were far more numerous in the gill-net catches than chum or pink salmon. In the red salmon catches larger and older fish were more abundant in northern latitudes. In winter, salmon were taken on all stations north of latitude 46° N., and the distribution pattern was similar to that found in summer, approximately 2° farther to the south.

Demand for electric power in the Pacific Northwest has stimulated private and public power agencies to propose construction of a high dam in Snake River canyon. There are several possible dam sites near the mouth of the Salmon River, a principal tributary of the Snake River and one of the major salmon-producing tributaries in the Columbia River basin. Up to this time, construction of a dam near the mouth of Salmon River has been avoided because methods of successfully passing both upstream and downstream salmon and steelhead migrants over a dam more than 100 feet in height are not known, and a dam constructed there would cause irreparable damage to the valuable fish runs of the Salmon River.

At the start of fiscal year 1962 this Bureau began an accelerated research program which seeks to develop methods for passing salmon and steelhead migrants successfully at high dams. The research is being conducted cooperatively by State fishery agencies of California, Oregon, Washington, and Idaho, and this Bureau. Studies are in progress on behavior of small and mature fish, and on methods of collecting and passing upstream and downstream migrants over dams. Louvered barriers and electrical fields show promise as means of deflecting downstream migrants to safe avenues of passage.



Laboratory worker examining serological plate. Blood samples taken from fish and analyzed by serological techniques permit research workers to identify origin or races of fish. For example, it appears possible to determine by this method whether a red salmon caught in the North Pacific came from Asiatic or North American stocks.



Extremely rough, mountainous country in the middle Snake River canyon complicates design, construction, and operation of fish passage facilities.

Devices for collecting downstream migrants in reservoirs are being improved. These collecting devices are, in effect, artificial surface outlets and are known either as gulpers or skimmers.

One of the knottier problems is posed by the apparent inability of small downstream migrants to find their way through the large, artificial bodies of water created by high dams. Although promising preliminary results have been obtained for a few of the problems, final answers to many problems have not been obtained.

In studies of endurance, steelhead trout and salmon have ascended an "endless" experimental fishway for elevations of more than 1,000 feet and one sockeye salmon climbed more than a mile. As a result of these experiments in the Bureau-operated Fish Passage Laboratory at Bonneville Dam, modification of conventional fishway design saved thousands of dollars in construction of fishways at Ice Harbor Dam. Further savings will accrue in construction of fishways as other dams are built.

Albacore Catch Prediction

Increased efficiency in the albacore fishery has been brought about by a new program of forecasting albacore abundance. A careful study of historical and current data on albacore distribution and sea-surface water temperatures has shown a high degree of correlation. In "cold" years albacore move farther south than usual, resulting in high catches south of the United States-Mexican border. Monthly and semimonthly maps of sea-surface temperatures in the eastern Pacific are now being published for use of fishermen in determining areas where albacore are most likely to be caught. Other charts, showing details of ocean bottom topography along the Central and South American coasts, are being prepared for the tuna fleet. These show seamounts and banks where it is known that tuna congregate to feed.

Shrimp

The technique of staining shrimp with colored dyes has been an important development in shrimp research. Dyed shrimp released in the estuaries have been recaptured on fishing grounds of the Gulf of Mexico, demonstrating that shrimp may migrate long distances and that estuaries are necessary to the maintenance of oceanic shrimp populations.

Stained shrimp were first successfully released at sea during the fall of 1961. Live stained shrimp were lowered to the bottom in a large closed box. Scuba divers opened the box and watched as the shrimp burrowed into the soft bottom. Marking and recovery studies have provided, for the first time, actual measurements of growth and mortality rates on shrimp. Preliminary results with marked pink shrimp on Tortugas and Sanibel grounds indicate rapid growth and high mortality. Similar experiments with brown and white shrimp are underway. Correct sizes for harvesting maximum yields can be determined from such studies.

Sea Lamprey and Lake Trout

The sea lamprey has virtually destroyed valuable stocks of lake trout in Lakes Huron and Michigan since it first invaded the upper Great Lakes in the 1930's. Lake trout in Lake Superior were decreasing rapidly when an all-out attack on the sea lamprey was launched with a newly developed selective chemical toxicant in 1958.

All streams known to be infested with sea lamprey larvae were treated by 1961. The selective treatment did not harm game fish but eradicated lamprey larvae and led to an 80- to 90-percent reduction in numbers of adult sea lampreys returning to spawn in the



Mobile bioassay laboratory in which streamside tests are made to determine exact amounts of selective chemical toxicant that will kill sea lamprey larvae but not other species of fish.

spring of 1962. This large reduction in numbers of adult sea lampreys is evidence that control is being achieved.

Rehabilitation of the highly prized lake trout population is well under way in Lake Superior. Nearly 6 million hatchery-reared lake trout were released in the lake from 1958 to 1962. These fish were produced in State, Fish and Wildlife Service, and Province of Ontario hatcheries. Millions more are to be planted each year until the population is restored. Survival has been excellent, and in many areas of the lake the hatchery-reared lake trout, marked by clipped fins, outnumber wild lake trout. As control of the sea lamprey is achieved, protective management measures are being started to conserve the small natural spawning stock of lake trout that remains.

Success in controlling the sea lamprey in Lake Superior has brought renewed hope for Lake Michigan, where lake trout also have become virtually extinct and other commercial species adversely affected. With the lake trout nearly gone, sea lampreys began preying on the larger species of chubs. A 2-year survey of the chub stocks of Lake Michigan, completed in 1961, showed that two of the larger species of chubs may be extinct and the abundance of others greatly reduced. The small, slow-growing bloater chub, once the main food of lake

trout, now constitutes over 90 percent of the fish population of Lake Michigan. Loss of lake trout and large chubs was a serious blow to the fishing industry. The industry has had to fall back on the small bloater chubs, alewives, and smelt for which prices are low and markets small.

Restoration of desirable species in Lake Michigan has begun. Sea lamprey larvae were eradicated in 26 tributary streams during 1960-



Biologists measuring changes in the species composition of Lake Erie fish stocks where pollution was found to be responsible for drastic declines of commercially valuable species.

61. Small trial plantings of hatchery-reared lake trout have been quite successful. These fish have survived well, have dispersed throughout the lake, and have grown rapidly.

Studies to find causes of drastic declines of blue pike and walleye in Lake Erie have produced evidence of marked environmental changes. Various chemicals related to domestic and industrial wastes flowing into the lake have increased steadily in recent years causing

severe depletion of dissolved oxygen in bottom waters over thousands of square miles of the lake. Dramatic changes have occurred in abundance of fish-food organisms living on the bottom. Pollution-tolerant worms have increased 4,600 percent and aquatic larvae of a small fly that can withstand low-oxygen conditions have increased more than 500 percent since 1929. The bacterial load at the outlet of the Detroit River increased threefold between 1913 and 1946-48.

Cisco, whitefish, and blue pike, that once thrived in the cool, clean water of central Lake Erie, have all but vanished from the oxygen-depleted waters. These species once contributed from 10 million to nearly 50 million pounds each year to the commercial catch, but in recent years only a few thousand pounds have been landed.

It is now evident that much of Lake Erie may no longer be a good habitat for walleye and yellow perch. Less-desired but more-tolerant species, such as carp, white bass, sheepshead, smelt, gizzard shad, and alewives, are more abundant. In addition, reports of large numbers of dead fish of all species have become increasingly common in recent years. Recent surveys have shown that at times no fish are present in areas where they once were abundant.

Blue Crab

Hand labor in the blue crab processing industry is expensive. In an effort to reduce costs of processing, the Bureau began a study to develop methods for mechanization. A contract was let to an engineering consulting firm to determine which steps in the processing could best be mechanized. The principal problem is that of producing a machine-picked meat equal in quality to handpicked meat. Machines for preliminary processing will be developed first and the actual picking machines later.

To aid the industry in immediately reducing processing costs while mechanization studies are underway, the same consulting firm conducted time-motion studies. These studies led to recommendations for cost-saving improvements in present hand-processing methods.

Radiation Preservation of Fishery Products

The program of low-level radiation preservation of seafoods has made significant advances. Irradiation of fresh haddock fillets and soft-shell clams indicates that the shelf life of these products can be extended 1 week or more.

Quality changes due to irradiation appear to be negligible. Further studies are underway on the effects of irradiation on the amino acids and vitamins in these products.

Fish Protein Concentrate

A new project to survey methods for producing fish protein concentrate for human food was begun during the year. Fish protein concentrate is a powdery substance made from fish. This product contains all the essential amino acids necessary for normal growth as well as many of the minerals and vitamins necessary to maintain body health. The aim of this project is to determine whether various processing methods now in use will yield a satisfactory, but inexpensive, product. If known processes are found to be inadequate, the study would then include the development of a satisfactory process.

Surveys have been made of the more important methods being developed in South America, Canada, Europe, and the United States. Enzymatic digestion coupled with solvent extraction appears to be the most promising approach.

Fish Oils

A new analytical technique, thin-layer silicic acid chromatography, has been developed to separate the many substances in fish oils. This technique has permitted significant advances in the Bureau's fish oil research and extension into new fields. Chemical components of fish oils now can be supplied to researchers in medicine, nutrition, and other fields.

Many authorities in nutrition and heart disease believe that the unsaturated fatty acids may be important in the prevention of some types of heart disease. The method also is being used to identify these unsaturated fatty acid components or fractions of fish oils, and those fractions which contain the characteristic fish odor.

Exploratory Fishing

Vessels of the Bureau's exploratory fishing fleet operated off the Atlantic and Pacific coasts, in the Gulf of Mexico, Caribbean Sea, and Great Lakes.

Experimental midwater trawling for ocean perch by the research vessel *Delaware* revealed that this species ascends from the bottom and scatters during darkness. At night only small and unprofitable quantities can be captured by present midwater trawls because the fish are scattered. Therefore, the fleet must remain idle on fishing grounds at night. Significant quantities of desirable sardine-sized herring were caught by midwater trawling in New England waters.

Good trawling grounds for yelloweye snapper were located by the Bureau's vessel *Oregon* in the western Caribbean Sea off the coast of Nicaragua at 70 to 110 fathoms. During the Caribbean work, numer-



Ultraviolet recording spectrophotometer being used for chemical studies on fish oils.

ous small schools of blackfin tuna were observed throughout the area explored.

Explorations by the Bureau's vessel *John N. Cobb* and charter vessel *Commando* off the Columbia River are giving increasing evidence that commercial forms of fish and shellfish may occur to depths of at least 600 fathoms in this area. Large catches of sablefish and Dover sole at well over 300 fathoms have aroused considerable interest among the commercial fleet regarding techniques which will enable the fleet to harvest these forms in the deeper waters of the continental slope. The apparent abundance of tanner crabs on bottoms 275 to 500 fathoms deep suggests strongly that commercial quantities of these crabs may be harvested along the continental slope from Oregon to British Columbia. These observations were obtained in the course of

investigations made under contract with the U.S. Atomic Energy Commission.

Explorations in waters of the Gulf of Alaska located commercial quantities of Dungeness crab between Lituya Bay and Icy Bay. Commercial fishing on these previously unknown stocks commenced soon after they were located. Bureau efforts to foster development of a fishery for underutilized and unutilized species in the Great Lakes, which have replaced the more valuable species, were strengthened considerably with the commissioning of the Bureau's 65-foot exploratory fishing and gear research vessel *Kaho*. The *Kaho's* first exploratory trips were made in Lakes Michigan and Erie.

Graduate Educational Grants

One of the principal requirements in developing the national oceanographic program is the need for well-trained research scientists. The Bureau of Commercial Fisheries took steps in 1962 to meet this need by awarding 17 grants for support of graduate students in marine science. Fields of study selected for support were physical, chemical, and biological oceanography, fishery biology, taxonomy, and food technology. Criteria for awards were developed in consultation with faculty representatives of universities with major programs in these fields. These consultants also assisted in selecting colleges and universities to receive the grants.

Recipients of awards will be selected by the universities. Each grant includes tuition, fees, and a living allowance. Grants were made to the following institutions: University of Washington, Oregon State University, University of California at San Diego, University of Hawaii, Texas Agricultural & Mechanical College, University of Miami, Duke University, the Johns Hopkins University, Yale University, University of Rhode Island, University of Michigan, and Massachusetts Institute of Technology.

Conferences

The United States hosted the FAO International Conference on Fish in Nutrition in Washington, D.C., in September 1961. The main objectives of the Conference were to bring together scientists in the fields of nutrition and fishery technology to evaluate what is known about the role of fish in nutrition and to facilitate orderly planning for future research in these fields.

The Conference was attended by more than 300 scientists from 35 countries and international organizations. Present knowledge was summarized in 33 review papers supported by 35 original scientific and technical contributions. Abridged and edited proceedings of the Conference, including all reports and discussions, will be published soon.

Oceanographic-Instrumentation Symposium

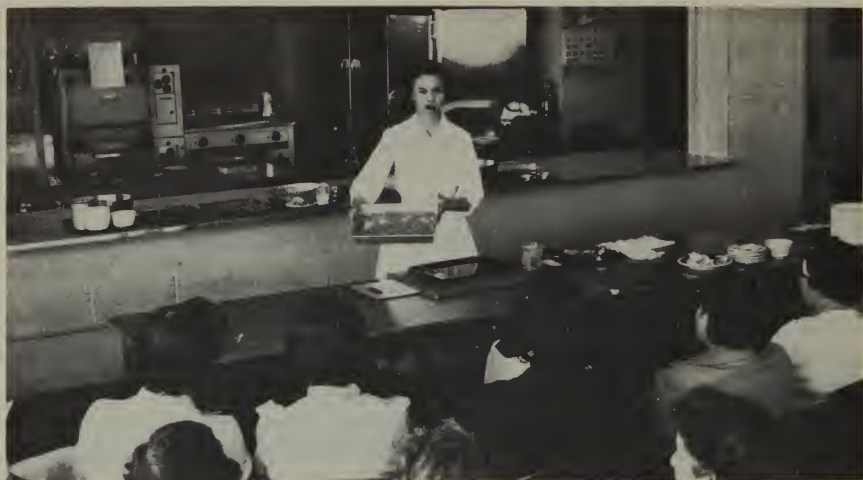
The United States is embarking on a long-range national oceanographic program of research and exploration. One of the most critical needs in this program is for new and improved instruments. To define the needs and to encourage industry to help solve them, the Government-Industry Oceanographic Instrumentation Symposium was held in Washington, D.C., in August 1961. The Symposium was sponsored by the Interagency Committee on Oceanography (ICO) of the Federal Council for Science and Technology. The Bureau of Commercial Fisheries played a prominent role in the planning for the meeting, which was held in the Department of the Interior Auditorium.

The Symposium was attended by 540 representatives from industrial concerns with an interest in oceanographic instrumentation, 139 representatives from Government, 32 from nonprofit institutions, 22 from the press, 4 from embassies of foreign countries—for a total of 737 attending. Since the meeting there has been a continued flow of proposals from the industry for the development of new instruments. Judging by the keen interest shown on the part of industry, the meeting was quite successful.

Services to Industry

In cooperation with the domestic fishing and allied industries and with State and other Federal agencies concerned with resource utilization, the Bureau provides regional and national educational and marketing programs. The purpose of these programs is to increase the utilization of fishery products.

Other services to the commercial fishing industry included development of standards, fishery product inspection, advice to cooperatives, production of motion pictures, television and radio announcements, and publications to promote consumption of fish, fish-cookery demonstrations, statistical surveys, and distribution of daily and monthly reports on fishery activities.



Bureau of Commercial Fisheries home economist demonstrates fish cookery to school lunchroom supervisors and cooks. Over 3,000 such demonstrations have been given since this program began in 1946.

Motion Pictures

An industry-financed, Bureau-produced, educational motion picture, "Fishing Five Great Lakes," was completed and another, "Watermen of Chesapeake," was started during the year. Twenty Bureau-produced fishery educational motion pictures are now in national distribution through about 180 cooperating film libraries and Government distribution channels. Most of the costs of production were paid by industry.

The annual viewing audience for these films is more than 2 million persons, exclusive of the audience exposed to public service television showings. Bureau motion pictures received two international and three national film festival awards during the year. Since 1946 the Department has received 18 international and national film festival awards for Bureau-produced educational motion pictures.

Promotion of Underutilized Fish

The Bureau continued to push aggressively in developing markets for underutilized fish. Markets were further expanded in the pet and mink industries, with a resultant increase in utilization of a number of fresh-water and marine fishes. Several major pet-food companies are now seriously considering expansion of existing production facilities and construction of new pet-food plants in the Great Lakes and Gulf areas.

Market development and technical assistance were given the Arkansas fish-farming industries to aid in the commercial production and utilization of fish grown in flooded ricelands. Fish crops are rotated with rice crops. The 1 to 2 million acres of lowland farms in Arkansas and adjacent States offer a tremendous fish-producing potential, estimated to be as high as 250 million pounds of fish annually, which could be used for human and animal food. At present, only a small portion of this potential is being utilized. This represents a vast potential reservoir to meet the future food needs of our expanding population.

Statistical Reporting

In January 1962, the Bureau began a new service to industry by issuing its first advance report on the fishery statistics of the United States. The report contained a preliminary review of landings and other fishery statistics available at the end of calendar year 1961.

A program of binding monthly and annual landing bulletins was undertaken for historical research purposes. Monthly and annual bulletins of landings for New York, New Jersey, and Florida, and of shrimp landings were bound for deposit in Bureau and State offices and laboratories and in the libraries of several universities.

The publication, Commercial Fishing Gear of the United States was released during the year. This was the first systematic arrangement, by type, of gear used by U.S. fishermen.

Market News Reporting

The Fishery Market News Service provides all segments of the fishing industry with current information on supplies, movement, distribution, demand, prices, and market conditions. Speed and accuracy are essential in disseminating these data. Fishermen, buyers, sellers, and distributors largely base their marketing decisions upon information contained in market news reports issued daily by the seven Fishery Market News Service offices. These offices are located at Boston, New York City, Hampton (includes data from Baltimore), New Orleans, San Pedro, Seattle, and Chicago.

A special report on New England sea scallops was published by the Boston Market News Service office. It includes a brief history of the fishery, an analysis of trends from 1939 to 1960, and a summary of important developments that affected the sale of scallop meats in domestic and foreign markets.

Special articles and news of fishery trends and progress in all phases of fishery research in the United States and abroad are presented in the monthly periodical, Commercial Fisheries Review.

News of trends and developments in foreign fisheries, transmitted by the Department of State from foreign reporting posts, are published in the daily Fishery Products Reports and Commercial Fisheries Review. More detailed reports on foreign fisheries are distributed to United States fishing interests upon request.

Fisheries Loan Fund Program

The fishing industry again received aid under the Fisheries Loan Fund Program authorized by section 4 of the Fish and Wildlife Act of 1956. New applications for 210 loans, totaling \$3.9 million were received during the fiscal year. The backlog of cases being processed was 32 at the beginning of the year and 29 at the end of the year. One hundred and ten applications, for a total of \$2.5 million, were approved and 54 for a total of \$1,285,000 were declined or found to be ineligible. Twenty-eight applications were withdrawn by applicants before final decisions were reached. Principal and interest collected during the year totaled \$2,070,000.



This tuna purse seiner, largest in the world, was converted from a former Navy minelayer with the assistance of the Fisheries Loan Fund.

These loans were made for financing and refinancing of operations, maintenance, repair, replacement, and equipment of fishing gear and fishing vessels. Commercial sources of financing for fishing vessels remained very scarce due to demand for financing by other industries and the depressed condition of the fisheries.

Fishing Vessel Mortgage Insurance Program

A companion program provides for insurance of mortgages and loans allowed for construction or reconstruction of fishing vessels. Ten applications, amounting to \$1,621,000, were received during the fiscal year. Six applications were approved for a total of \$1,090,000. One case was pending at the beginning of the year and four cases were pending at the end of the year. One application was withdrawn by the applicant.

Fishing Vessel Construction Subsidy Program

The purpose of the subsidy program is to provide financial assistance to correct inequities between foreign and domestic costs of fishing vessel construction. The first construction differential subsidy was approved during the year. Four applications for subsidies amounting to \$409,500 were received during the year. Three were carried over from the previous year, and two were pending at the end of the year. Five subsidies, totaling \$507,600, were approved. Actual payment of these subsidies will not be made until construction of the five vessels involved is completed. All vessels were designed for fishing in the New England groundfish fishery.

Developments in Foreign Fisheries and Trade

Expansion of fishing effort on the high seas by many foreign nations is introducing new methods of marine fishing, and is leading to unusually rapid development of marine fisheries. These new methods utilize factory ship stern-trawlers, new and larger trawls, mothership operations, and fully integrated fleet operations that catch and completely process the fish at sea. The Bureau utilizes timely information on fisheries of foreign countries in its programs to keep the domestic fishing industry informed on these new developments. To assure that the U.S. Government and the domestic fishing industry are aware of the latest advancements in foreign countries, the Bureau operates, in collaboration with the Department of State, a foreign reporting program covering worldwide fishing events. Fishery attachés assigned to U.S. Embassies in Copenhagen, Tokyo, and Mexico City, report on latest fishery developments in their areas. Other important fishing areas of the world were covered by U.S. Embassy and consulate personnel. In addition, fishing activities

of the U.S.S.R., as well as newly created fishing opportunities in the African countries, were reported in monthly briefs issued by the Bureau.

The past year has witnessed Russian, Polish, and Norwegian fishing activities off the New England coast and Russian fishing activities off the Middle Atlantic States. Japanese and Russian fleets continued to fish off Alaska. In addition, Japanese tuna fleets are operating in the Atlantic and plans are underway for Japanese vessels to take groundfish in the northwest Atlantic.

Trade and Tariff Matters

Formation of the Common Market in Europe and increased fishery production by several foreign countries have brought new challenges and trade problems for the fishing industry. To enable domestic fishery products to compete in foreign and domestic markets, the Bureau's trade and tariff specialists worked on committees concerned with international trade, and also prepared comprehensive, interpretive market studies covering foreign regulations and controls on American fishery commodities. Actions were taken to seek the removal of such restrictions.

A specialist in fishery trade matters was placed on the U.S. delegation to the 1961 tariff negotiating conference held under the General Agreement on Tariffs and Trade (GATT). In another action, the regional fishery attaché for Europe was assigned as U.S. representative to the Fisheries Committee of the Organization for Economic Cooperation and Development, which has been studying problems of fishery trade among the 20 nations of this Atlantic community.

International Programs

Through the U.S. FAO Interagency Committee, the Bureau aided in developing fishery programs of the Food and Agriculture Organization of the United Nations. Although FAO's programs are mainly designed to aid newly developing countries move toward economic stability, many programs have contributed much to the progress of the fisheries in more advanced countries. During this past year, owing in large part to the FAO International Meeting on Fish Meal held in March 1961, domestic and international fishmeal markets were stabilized. FAO, principally at the instigation of the Bureau, is now

conducting a program to increase consumption of fish protein concentrates in developing countries.

During the year the Bureau also made a 3-month survey of the fisheries in West Africa for the Agency for International Development (AID). The objective was to increase the supply and demand for fishery products in the developing countries of West Africa.

International Conservation of Marine Resources

Providing for conservation and wise utilization of marine fishery resources, now being taken by U.S. and foreign fishermen in increasingly large amounts, is a major Bureau responsibility. Bureau officials participated in numerous international fishery meetings to guide rational exploitation of valuable oceanic species and, simultaneously, to protect the rights of U.S. fishermen.

International commissions where fishery issues are resolved include the International Whaling Commission, International Pacific Salmon Commission, International Pacific Halibut Commission, Inter-American Tropical Tuna Commission, North Pacific Fur Seal Commission, and the International Commission for the Northwest Atlantic Fisheries. At meetings of these commissions, Bureau officials have worked to protect the world's whale stocks; salmon, halibut, tuna, fur seal, and other resources of the Pacific Ocean; and fisheries for bottomfish and scallops in the Northwest Atlantic.

Columbia River Development Program

The Columbia River Fishery Development Program, financed and supervised by the Bureau, is a cooperative program of the State fish and game agencies of Idaho, Oregon, and Washington, and the two bureaus of the Department of the Interior's Fish and Wildlife Service.

Started in 1949, the program has been instrumental in maintaining anadromous fish runs in the Columbia River despite extensive development of water-use projects. Twenty-one hatcheries have been renovated or newly constructed for artificial propagation of salmon and steelhead, to offset as far as possible losses of natural spawning and nursery areas.

In addition, irrigation diversions have been screened to prevent entry and losses of fish in such diversions; streams cleared to remove debris, old dams, and logjams; and fishways constructed at falls in an effort to develop and maintain all areas suitable for continued natural production of salmon and steelhead.

The program also constructed the Western Fish Nutritional Laboratory at Willard, Wash., and has financed a large part of the research performed there. During the year, an extensive study to evaluate the success of hatcheries was begun.

In the spring of 1962 approximately 8 million fall chinook salmon fingerlings, from all hatcheries rearing that species, have been marked by cutting off certain fins. Recovery of marked fish from the commercial and sport fisheries, and from hatcheries, will provide the basis for determining survival, harvest, and maintenance of runs. It is anticipated that approximately 10 million fish will be marked each year for the next 4 years. An extensive sampling program to recover marked adults will be conducted along the Pacific Coast, in the Columbia River, and at the hatcheries.

Fur Seal Operations

In performing its function as administrator of the U.S. fur seal industry, the Department harvested 95,974 sealskins from the Pribilof Islands, Alaska, during the summer of 1961. This harvest, largest in recent years, stemmed from management practices based on research and bore out forecasts. Under the terms of the Interim Convention on Conservation of North Pacific Fur Seals, Canada and Japan each received 15 percent of the sealskins taken, plus 188 additional skins.

During fiscal year 1962, 53,990 U.S.-owned sealskins were sold for \$2,742,758. Under the terms of the Alaska Statehood Act, 70 percent of the net proceeds from the sale of sealskins is payable annually to the State of Alaska. The third annual payment to the State, in the amount of \$536,809, based on net proceeds accruing during fiscal year 1961, was made late in 1961.

On January 22, 1962, the Department notified the Fouke Fur Co. that its contract for processing and selling sealskins as agents of the United States was terminated effective December 31, 1962. This company has processed and sold Alaska sealskins in St. Louis, Mo., under an exclusive contract with the United States for the past 40 years. The company has moved its sealskin processing operations to a new plant located in Greenville, S.C.

In June 1962 copies of an "Invitation for Proposals and Prospectus for Processing and Selling Alaska Sealskins" were distributed among a substantial number of fur processing firms, individuals, and organizations. The invitation asks for submission of proposals to the Department for providing services for processing and selling U.S.-owned Alaska sealskins. Proposals submitted in response to this invitation are expected to form the basis for a new sealskin processing contract.



Removal of blubber is an early step in processing seal skins. Trained workers are shown performing this preliminary step in skin processing on St. Paul Island.

Construction

Construction of laboratories and vessels continued during the year. Completed were a major laboratory and its associated aquarium, a salt-water laboratory, and a research vessel. Another major vessel, the *Albatross IV*, was launched and will be completed in fiscal year 1963.

Biological Laboratory at Woods Hole

The Bureau's new biological laboratory at Woods Hole, Mass., was dedicated on June 23, 1962. The original laboratory at Woods Hole was established in 1871. The new, well-equipped, three-story laboratory building has 24,000 square feet of floorspace. A second building houses an aquarium, primarily designed for experimental work on fish physiology and behavior.

In summer a portion of the aquarium is open to the public. The public tanks and displays, first opened to the public in the summer of 1961, have proved highly popular. The astonishing number of more than 200,000 persons visited the aquarium between July 1 and September 10, 1961.

The laboratory's dock facilities will accommodate oceangoing vessels, including the Bureau's new fishery-oceanographic research vessel *Albatross IV*.

East Lagoon Salt-Water Laboratory

Two important additions were made to the biological laboratory at Galveston, Texas, during the year. One was a circulating sea-water system at the main laboratory, and the other a sea-water laboratory at East Lagoon, which is located about 3 miles east of the main laboratory. The sea-water laboratory is raised about 15 feet above sea level to avoid hurricane damage. It is on a 40- by 90-foot concrete slab with a large concrete tank on the roof of the building. Whereas the recirculating system at the main laboratory provides rather well-controlled conditions of salinity and temperature, the East Lagoon laboratory will give an opportunity, especially in the case of estuarine species, to study organisms under seminatural con-



New sea-water laboratory at East Lagoon, Galveston Island. Continuously circulating sea water permits study of aquatic organisms under seminatural conditions.

ditions. Studies of shrimp behavior and physiology are underway using these facilities.

Research Vessel "Kaho"

The Bureau's vessel *Kaho* was commissioned during the year for research on the Great Lakes. This steel vessel resembles a Pacific-coast combination seiner-trawler. It is 65 feet in length and is equipped with the latest marine-electronic equipment, including radio, fish detection equipment, automatic electric hydraulic steering system, and radar. Deck equipment includes trawling and bathythermograph winches necessary for fishery explorations.

The *Kaho* will be used to locate and determine the potential commercial production of underutilized stocks of fish and develop the most efficient methods and gear to harvest them.

Research Vessel "Albatross IV"

Construction is proceeding satisfactorily on the *Albatross IV*. This \$1.7 million vessel has been launched and is in the final stages of completion. The 187-foot stern-chute trawler will operate from Woods Hole, Mass., as a fishery and biological oceanographic research vessel.

Office of the Assistant Secretary Mineral Resources

John M. Kelly, Assistant Secretary

Several new or expanded activities were undertaken by the Office of the Assistant Secretary for Mineral Resources in 1962 with respect to the Department's programs in research, development, and utilization of minerals, metals, and fuels.

With an objective of creating a unified policy to supplant the existing bureau-by-bureau approach, the Assistant Secretary established a Departmental Energy Policy Staff composed of representatives of various energy-related bureaus and offices. In taking an overall view of energy policy, the staff reviewed and commented upon staff studies of the National Fuels and Energy Study of the Senate Interior Committee and prepared energy reports for the use of the Department and other Federal agencies.

Other activities of the Office of the Assistant Secretary included the following:

Participating in petroleum committee meetings of NATO and the OECD in discussions centering about petroleum supply.

Participating in meetings of the International Lead and Zinc Study Group to examine market developments for lead and zinc during 1961 and to consider the outlook for 1962.

Meeting with domestic lead and zinc industry representatives as a part of an effort to establish continuing consultation with various segments of the mineral producing industries, and holding field hearings on the new lead-zinc subsidy legislation.

Assisting the Resources Panel of the National Academy of Sciences in drafting a report for the President covering the complete scope of existing and recommended natural resources research.

Participating on the Petroleum Study Commission established by the President to study the oil import program.

Assisting at departmental conferences aimed at establishing a basis for a survey of the damage to natural resources resulting from strip and surface mining.

Preparing background material and testimony for the Department on coal slurry pipeline possibilities, and on Federal eminent-domain legislation for such pipelines.

Making field studies and consulting with other Federal and State agencies concerning area redevelopment programs.

Coordinating U.S. activities in connection with the Second Symposium on the Development of Petroleum Resources of Asia and the Far East, scheduled for September 1962, at which the Assistant Secretary was to be the Chairman of the U.S. delegation.

Continuing reviews of proposals for minerals stockpile action and participating on the Executive Stockpile Committee.

Assisting in the clarification of mineral industry advisory relationships with government in relation to Executive Order 11007 and the Presidential memorandum of February 9, 1961.

Directing a panel of the National Academy of Sciences in selecting and preparing U.S. papers for the United Nations Conference on the Application of Science and Technology for the Benefit of the Less Developed Areas.

In discharging the mineral resource responsibilities of the Secretary of the Interior, the Assistant Secretary exercises continuing supervision over eight bureaus and offices of the Department: The Geological Survey, Bureau of Mines, Office of Oil and Gas, Office of Geography, Office of Minerals and Solid Fuels, Office of Minerals Exploration, Oil Import Administration, and Office of Coal Research.

Geological Survey

Thomas B. Nolan, *Director*



What new frontiers can the Geological Survey of the Department of the Interior explore to aid in the conservation of our natural resources and to help maintain this Nation as the world's most prosperous? This is a question constantly before us as we strive to think in terms of what our country's requirements for new maps, metals, minerals, mineral fuels, and water resources are going to be—5, 10, or 20 years from now.

For more than 83 years, the Survey has conducted basic research in scientific and engineering fields to provide the mapping, exploratory, and analytic knowledge needed for wise use of nature's gifts.

In preparing and publishing topographic maps, the search for new tools and techniques continues. Replacing the pre-World War II topographer, whose principal items of equipment were the plane table and alidade, is a modern scientist-engineer counterpart who uses a variety of precision optical and mechanical instruments to mass produce the greatly improved maps demanded today. Aiding him are aerial cameras with wide-angle lenses that collect a vast amount of information on each photograph; stereophotogrammetric plotting instruments that enable him to interpret and plot terrain detail with utmost accuracy; electronic distance-measuring devices that reduce the cost, toil and inaccuracies "pulling chain"; a vehicle-mounted electronic elevation meter which permits measuring differences in elevation with no more effort than is needed to drive an automobile; and vastly improved cartographic drafting and printing procedures that lend tremendous versatility in reproducing intermediate and final map drawings. During the past year, work has begun on a comprehensive national atlas, to be produced with the

scope and of a quality suitable to the U.S. high position in scientific and technologic fields.

Exploration for and appraisal of mineral and water resources are never-ending tasks. Here too, new frontiers are not geographic, geologic or hydrologic alone, but involve new instrumentation and the fringe areas of many disciplines whose unexplored regions can yield valuable knowledge. Geochemists, geophysicists, mathematicians, and volcanologists are among Survey researchers exploring new approaches to the origin of ores and fuels. Such knowledge is vital to future success in seeking out sources of supply of mineral raw materials and the maximum utilization of water resources.

The recent explosive growth in the use of a dozen or so elements that were hardly known outside the chemical laboratory a few years ago illustrates this point—beryllium, niobium, selenium, tellurium, germanium. Magnesium, zirconium, and titanium are performing tasks either entirely new or formerly fulfilled by other metals. We would be in a bad way, indeed, so far as our reserves of needed materials are concerned, if it were not for technological advances not only in the development of new sources but in uses for different materials.

Our recent extension of geologic research into areas formerly exclusive to oceanography provides another new frontier: one which geologists and hydrologists should have explored more thoroughly long ago. The study of geology should not stop at the seashore or even at the 100-fathom line. The broad aspects of new Survey objectives in marine geology and hydrology have been worked out. These will be carefully integrated with the objectives and programs of other Government bureaus and educational institutions. Many prospective projects, though oceanographically oriented, are already tied in with the Survey's regular research program.

Finally, we believe we have found a workable solution to our growing communication problem involving the time-lag between scientific discovery and public availability of new knowledge. Regardless of where the difficulties may lie, it is apparent that new facts known only to the discoverer are valueless to the using public. In 1960, Geological Survey began publishing short synopses of current geologic and hydrologic research results, thus making the principal findings quickly available. Many of these short papers are followed by reports in greater detail in later publications. Though sometimes tantalizing to professional associates who want more information immediately, this practice of rapid publication has proved highly popular and is filling a longstanding need.

Geologic Division

Full and efficient use of our mineral resources in the development of the national economy in this the latter part of the 20th century is dependent on an ever more detailed knowledge of the nature of these resources and the geologic processes that produce them. To that end the Geologic Division is engaged in a variety of scientific studies that range from analysis of samples from the depths of the Mohole or meteorites from extraterrestrial sources to broad-scale field investigations of geologic, geophysical, and geochemical phenomena in areas from the Arctic to the Antarctic, from the Atlantic seaboard to the Trust Territory of the Pacific Islands.

Several of these studies are undertaken on behalf of other Federal agencies, including the Defense Department, the Atomic Energy Commission, the National Aeronautics and Space Administration, the National Science Foundation, Agency for International Development, Bureau of Public Roads, and the Department's Bureau of Mines and Office of Minerals Exploration. Others are being carried out in cooperation with 15 States, the Commonwealth of Puerto Rico, the county of Los Angeles, and the city of Seattle.

Geologic Publications

Results of the survey's Geologic Division's investigations were published during fiscal 1962 in 75 professional papers and bulletins, 3 circulars, 136 geologic maps, and some 190 technical papers in scientific journals. An additional 63 reports were made available in files open for public reference. Important findings and a synopsis of current research were published in Professional Paper 424-A, "Geological Survey Research, 1961," and 298 short papers summarizing results of individual studies in progress were published in chapters B, C, and D of that report. In order to present new findings as rapidly as possible, the first chapter of short papers for "Geological Survey Research, 1962" has been separately published, as Professional Paper 450-B. It includes 26 additional short papers on current research in the Division's studies.

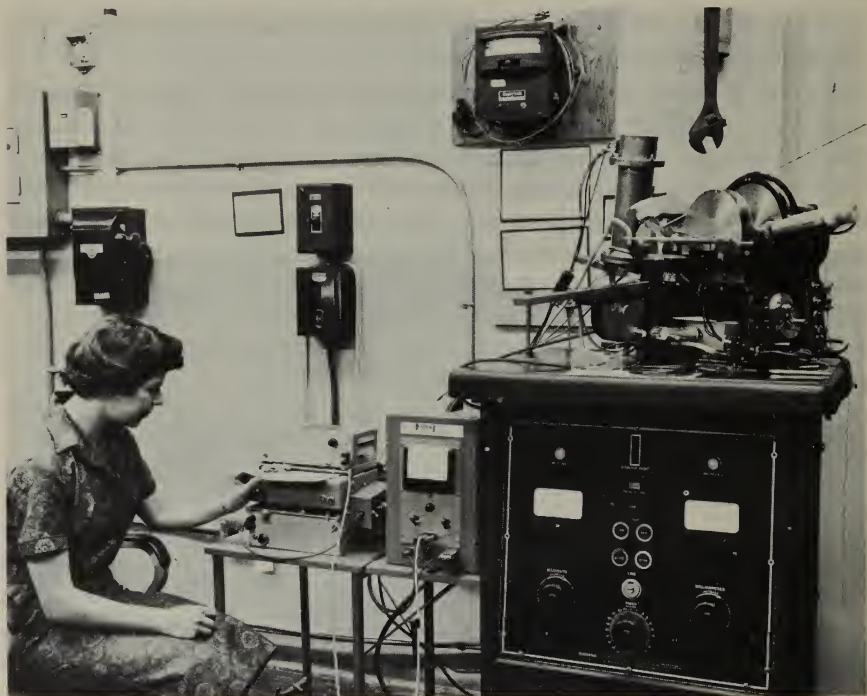
Economic Geology

Research and investigations in economic geology have an immediate application in filling current needs for mineral raw materials, in the solution of engineering problems and the guidance of land development, in guarding public health and safety.

During the past year, potential iron ore has been identified in a mineralized sequence of volcanic rocks in the northern Cortez Moun-

tains, Nevada, and an iron-bearing formation up to 50 feet thick has been found in the Tobacco Root Range, Mont. The first known deposit of zinc minerals in Ohio has been found at Serpent Mount in the southern part of the State.

Abundant near-surface manganese minerals and alteration of associated rocks in the Drum Mountains, Utah, resemble closely the surface conditions overlying the rich silver-lead-zinc deposits in the Tintic mining district. In several other parts of the Southwest surface veins of manganese oxide minerals apparently may be used as



Geological Survey geologist measures thermoluminescence of a mineral—its ability to emit light when gently heated. Variations in thermoluminescence near ore bodies may provide a new exploration technique.

a guide to significant amounts of lead, zinc, silver, and copper at depth. Variation in the thermoluminescence of white dolomite associated with zinc-lead-silver ore at Gilman, Colorado, suggests a possible new exploration tool.

A beryllium deposit of potential economic significance was discovered at Rapid River, Alaska, about $4\frac{1}{2}$ miles from previously reported beryllium deposits in the vicinity of the Lost River tin mine.

In the Piedmont region of South Carolina, a correlation has been found between regional zones of mineral deposits and hitherto unrecognized regional metamorphic zones.

Uranium has been one of our most intensively studied raw materials during the past decade and a half. Synthesis and analysis of the tremendous amount of data acquired in these studies is now underway. In the regional and mining district studies on uranium, several mineralogical, geochemical, structural, and stratigraphic guides to ore deposits have been developed. For example, in the Moab-Interriver area, Utah, a cobalt halo extends as much as 80 feet into the sandstone around one deposit. In uranium-bearing sandstones in the Disappointment Valley area, Colorado, and in the Shirley Basin of Wyoming, black, opaque heavy minerals, normally present, are almost completely absent close to mineralized rock.

Thorium-bearing veins in the Wet Mountains, Colo., are now found to be of Tertiary age, and not Precambrian as formerly supposed. This change suggests a broader area should be examined for similar deposits. Some of these veins also contain as much as 0.3 percent niobium.

Geologic mapping and detailed mineralogic studies at Searles Lake, Calif., indicate the possibility that concentrations of saline minerals, concealed beneath present-day playas, may be detected by studies of the stratification and mineralogy of exposed sediments peripheral to the basin.

Mesquite leaves and twigs have been found to accumulate zinc, lead, barium, and strontium, as well as the copper and molybdenum previously reported. The usefulness of analyses of ash from mesquite is thus extended in the search for geochemical clues to hidden ore bodies in the alluvium-covered areas of the Southwest.

In mineral fuels investigations, a significant new appraisal of the future petroleum-producing capacity of the United States concludes that our producing capacity is in no way restricted in the immediate future by the remaining quantity of undiscovered oil, but is dependent primarily on economic incentives that encourage exploration.

Potential resources in the oil shales of the Green River formation have been increased by the discovery that the top 43 feet of the richly petroliferous Tipton shale member is continuous and relatively uniform over an area of about 1,400 square miles in the southern part of the Green River basin of Wyoming.

Areas of recurrent or potential landslides pose special problems in planning for urban development, in locating highways, and in other major construction problems. In the Malibu Beach area of Los Angeles County, newly available geologic maps that indicate such areas have proven very useful to public officials, real estate developers,

and potential homeowners. Identification of ancient landslides along a proposed route of a major sewage disposal system for the Seattle metropolitan area resulted in selection of an alternate route. Studies in engineering geology also are helping in the selection of a highway route between Talkeetna and McGrath, Alaska.

Processes that change the shape of our shorelines have been studied in efforts to develop possible protective measures for use in areas of special interest. Short-term changes have been observed in detail to improve our ability to predict and possibly prevent undesirable changes.

Public health and safety are the primary objectives of studies on the disposal of radioactive waste, drainage of mine waters, and the distribution of various elements in nature that may be related to incidence of disease.

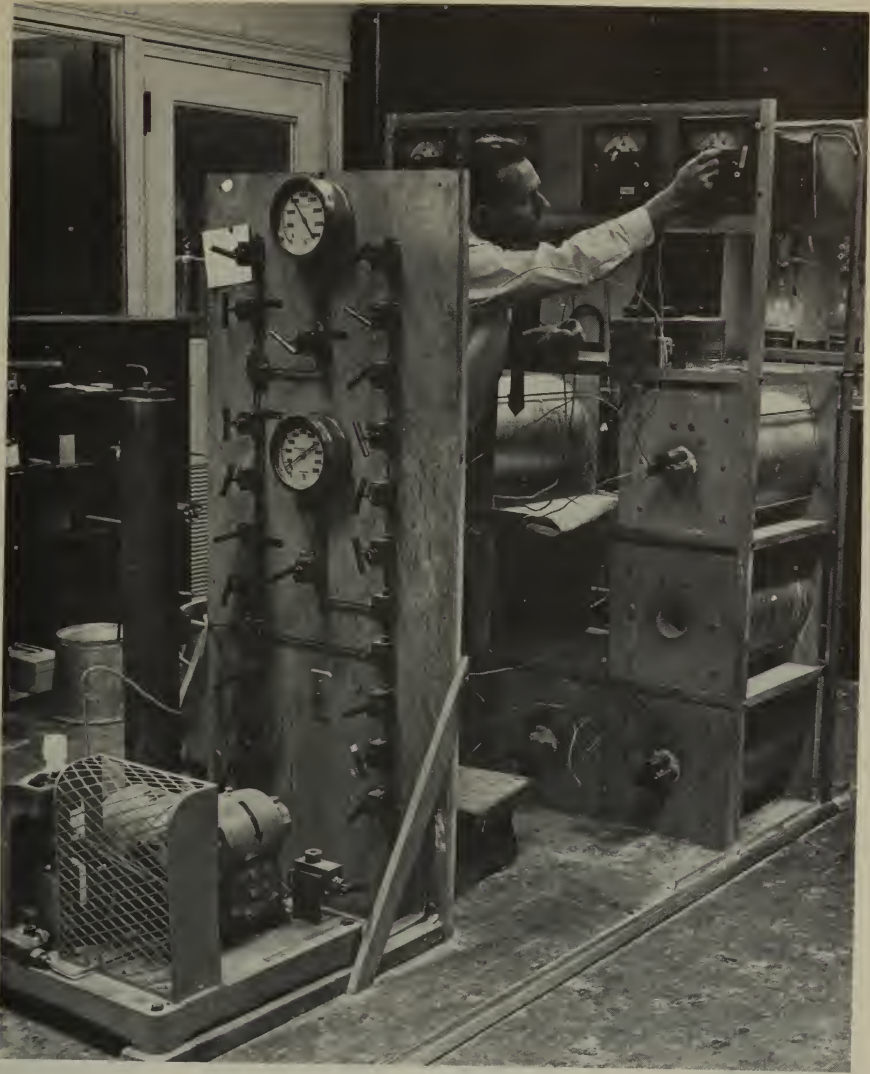
Regional Geology

The earth's crust as we now observe it has been formed by a complex sequence of events. Basic to its understanding is an accurate record of its present state—the geologic map—from which can be inferred and interpreted relations at depth and the processes by which the present state was attained. Modern geologic mapping makes full use of geophysical, geochemical, and paleontologic studies to supplement direct observation.

Publication was authorized during the year of 200 geologic and geophysical maps. In addition to maps of specific areas, maps that summarize information on large areas are prepared. Published during the past year was the tectonic map of the United States. This map, prepared jointly with a committee of the American Association of Petroleum Geologists, shows the major structural elements and provides a framework for delineating major mineral provinces in the search for useful materials. A preliminary geologic map of Puerto Rico was made available to assist planning and development of mineral resources, including deposits of chemical-grade limestone and of copper minerals such as the one now being explored near La Muda. Announcement last year of the identification of very thick deposits of low-gravity sediments favorable for the accumulation of oil in the basin west of Nenana, Alaska, attracted the attention of oil producers, who have leased some of the area and are beginning exploration.

Experimental Geology

Natural processes by which the many different kinds of rocks and minerals have been formed can be observed rarely—only when they occur at or near the earth's surface. Many rocks and minerals are



Geological Survey geochemist is shown with hydrothermal equipment used to study the effects of steam and various other high temperature and pressure chemical environments on rocks and minerals to determine conditions under which minerals were formed.

known to form at some depth in the earth under various conditions of heat and pressure and over extended periods of time. The processes of their formation can only be inferred, and detailed geochemical and geophysical experiments in the laboratory provide the basis.

Isotopic analyses are becoming a standard method of providing accurate age-dating of critical events in the development of the earth.

During the past year announcement was made that the oldest mineral yet found in the United States—a zircon from the Morton gneiss in southwestern Minnesota—is 3.2 billion years old.

Isotope studies of the migration of lead in metamorphic rocks offer an exciting new approach to the search for ore deposits. For example, feldspar minerals near Bear Mountain, N.Y., contain an unusually large amount of radiogenic lead, and suggest the possibility of uranium deposits nearby.

Chemical studies of the structure of serpentine-group minerals, the solubility of water in silicate melts at high temperatures and pressures, and the role of sulfur in ore-forming processes, continue to provide data that help us interpret natural processes.

New analytical procedures and techniques provide faster and more accurate chemical analyses for the large number of samples obtained in all studies. Equipment has been designed and put in operation that provides the analysis for as many as 22 elements simultaneously and records the data in the same process. A new technique to provide spectroscopic analyses of samples weighing a milligram or less permits estimates of concentration of 68 elements.



Geological Survey geologist quenches an experimental sulfide mineral batch for studies in environment of ore deposition.

Geologic studies have helped select the sites for underground nuclear test explosions, and have materially aided in studying the effects of such tests. Information derived from study of seismic waves from the tests is being used in advancing our ability to detect clandestine tests, as well as providing much information on deep crustal structures. As a result of studies related to nuclear testing, the possible use of underground nuclear explosions to create artificial harbors is being explored.

Foreign Geology

Technical assistance to foreign governments is primarily intended to provide advisory services and help in training earth science specialists in the development of their economies through better understanding of their natural resources. This assistance under the auspices of the Agency for International Development included the training, advisory, and service functions of 56 Geologic Division scientists working in cooperation with their host country counterparts in 12 nations, sharing advances in methods and techniques of geologic research and investigations; and the training in this country of some 53 earth scientists and technicians from 22 countries.

During the year, the Brazilian iron project in the State of Minas Gerais neared completion. This project during the past 15 years has produced geologic maps of about 7,000 square kilometers, and some 38 economic and scientific reports; 17 additional comprehensive reports are nearing completion. Many Brazilian geologists have received training and contributed to the studies. The work has resulted in the discovery of sufficient iron ore reserves to justify the establishment and continued life of a Brazilian iron industry.

In Bolivia, where cooperative work began only last year, two Bolivian geologists using newly acquired techniques discovered two ore-bearing veins through geochemical prospecting methods and three other veins by electromagnetic surveys.

A geologic map of Libya was compiled to make information available for resource development. A geologic map of the Arabian Peninsula was also completed. In Pakistan, a variety of mineral resources were investigated including glass sands, manganese, coal, and heavy mineral placers; and in one study a deposit containing about a half million tons of barite was discovered.

In Thailand, where the mineral industry formerly included only tin and tungsten, new diversified industries can now be based on manganese, gypsum, ceramic clays, coal, and fluorite. In the Philippine Islands, commercial exploration was begun of chromite deposits that became known as a result of Survey studies. More than 600,000 tons



Geological Survey geophysicists searching in the field for buried ore bodies by means of the Slingram method. Electromagnetic waves, transmitted by a battery-powered portable antenna coil, out of view to the right, are received by coil on the left; ratiometer and amplifier unit, shown on the right, compare the received signal with the transmitted signal, showing disturbances of the electromagnetic field which could be caused by a buried, electrically conductive ore body.

of refractory-grade chromite ores have been outlined by diamond drilling.

Conservation Division

The principal tasks of the Survey's Conservation Division are to classify Federal lands as to mineral and water resources and supervise mineral recovery under leases, permits, and licenses on Federal, Indian, and naval petroleum reserve lands. A headquarters staff and a field staff of geologists and engineers make surveys, maps, and reports dealing with water power, fuels, minerals, and chemicals essential to the economy of the United States; supervise mining and drilling operations to assure safe and economical production by private enterprise of coal, oil, gas, and other minerals; and supervise operations of the Federal Petroleum Board.

Mineral Classification

During fiscal 1962, a total of 28,506 cases were processed by the Survey, including 3,700 cases involving the outright disposal of Federal lands either with no reservation of minerals or with the reservation of one or more specified minerals. There were 23,383 cases involving the exercise under Federal leasing laws of the Government's right to lease a mineral substance to private enterprise.

Initial or revised definitions of 257 producing oil and gas fields were made on or affecting Federal leaseholds; 111 reports were made on the mineral potentialities of certain lands for various agencies of the Federal Government; and 594 reports were made to industry or individuals in connection with activities on Federal lands involving unit plans, participating areas, productive limits, and associated matters. Geologists from field offices throughout the West also made investigations and produced reports and maps as needed in assisting engineers in planning development and in administering Federal leases.

In the classification of the public lands, approximately 1,309 square miles were mapped geologically. Classification actions for approximately 1,944 square miles in the coal fields of New Mexico, Montana, and Colorado were completed.

The following maps or reports were completed during the year: a preliminary structure contour map of the east side of southern San Joaquin Valley, Kern and Tulare Counties, Calif.; a contour map drawn on the Vedder Sand (Temblor Formation, Miocene) in the southern part of San Joaquin Valley, Calif.; coal classification in the Yampa Coal Field, Routt and Moffatt Counties, Colo.; a map of the Northeast Rangely coal area, Colorado; a subsurface study of the Paradox Basin, Utah and Colorado; a geologic map of Garns Mountain SE quadrangle, Idaho; a structure contour map of the Blue Buttes oilfield, North Dakota; a map showing the occurrence of coal in the Upper Cretaceous Mesaverde Group, Uinta Basin, Utah; a cross section of the Kane Springs Wash anticline, Utah; a subsurface study of Wasatch sands development in southeastern Uinta Basin, and a geologic map of the Paradise quadrangle, Utah.

Revisions of maps showing areas of prospective value for oil and gas, for several states and maps for bitumens, coal, oil shale, phosphate, and salines, were made.

Three bulletin chapters on geologic investigations of waterpower sites in Alaska were published.

Waterpower

Investigations were continued to determine the potential of streams on the public lands for waterpower and conservation storage of

water. The program is largely confined to the Western United States and Alaska where the bulk of the remaining public lands are located. Maps of 125 miles of stream valley and six dam sites were published. These included maps of Olive, Kunk, and Anita Lakes in Alaska and of portions of Kern River, Calif.; Lemhi River, Idaho; and Smith River, Oreg. Reports on the waterpower resources of southeastern Alaska, Bradley River, Alaska, and Wilson River, Oreg., were published as water supply papers. Four reports on the geology of waterpower sites in Alaska were published as bulletins of the Geological Survey. These maps and reports provide the basis for classification of the public lands as to their value for water resources development and provide invaluable information to possible developers of those resources.

The review of longstanding withdrawals of lands for waterpower and water storage purposes was continued. Four reports were completed in which power and storage values of 92,000 acres were reviewed. Of this area, 73,000 acres were recommended for restoration from withdrawal.

Work was started on a revision of estimates of the developed and undeveloped waterpower resources of the United States. Results will be published by the Geological Survey along with estimates of reserves of other energy producing resources.

Two hundred fifteen reports were prepared and submitted to the Department's Bureau of Land Management on the waterpower value of lands affected by applications for right-of-way easements and 3,700 reports were made on applications for land acquisition. Twenty-eight waterpower reports were made on applications to the Federal Power Commission for restoration of lands in powersite withdrawals.

Mining

Supervisory control is exercised by the Survey over mining activities concerned with prospecting, development, and production of minerals under permits and leases on public, Indian, and acquired lands.

Permits and leases issued under applicable laws and regulations involve operations for coal, potassium, sodium, and phosphate on public lands and such metals and minerals as copper, iron, lead, manganese, nickel, tungsten, uranium, vanadium, zinc, asbestos, barite, bentonite, clay, coal, garnet, gypsum, feldspar, fluorspar, limestone, mica, peat, phosphate, pumice, quartzite, quartz crystal, sand and gravel, stone, and vermiculite on Indian and acquired lands.

Mining supervision includes responsibility for investigating and reporting on applications for leases and prospecting permits; recommending lease terms, enforcing compliance with lease terms and regulations governing the conduct of prospecting, mining, and milling operations; and determining royalty liability of lessees, maintaining accounts, preparing statements and receiving payment of royalties and rentals.

As of June 30, 1962, there were under supervision 2,497 properties involved in leases, permits, and licenses in 31 States of which 1,456 were on public land, 276 on acquired land, and 765 on Indian land. Production from such lands during the fiscal year is estimated at 26,478,700 tons, valued at \$163,108,000 with royalties amounting to \$8,024,400.

In order of magnitude of production, potash ranked first with 12,217,000 tons, valued at \$74,122,500, followed by coal 5,869,800 tons, valued at \$33,872,800; sand and gravel 3,456,500 tons, valued at \$2,356,100 and phosphate 1,969,500 tons, valued at \$3,274,000. Other production in substantial quantity includes uranium ore, 1,302,700 tons, valued at \$20,398,000; and sodium compounds, 1,009,200 tons, valued at \$25,068,000.



Texas Sulphur Co.—potash mine development on Colorado River at Kane Springs Wash, Utah.

Oil and Gas

Supervision of oil and gas activities includes operations for the discovery, development, and production of crude oil, natural gas and products extracted from natural gas, on Federal, Indian, and certain military and naval petroleum reserve lands.

Unitization activities of oil and gas operations involving public and acquired land were reflected in the approval of 85 new unit plans during the year and the termination of 72 that had been previously approved, leaving 453 approved plans covering 8,197,703 acres outstanding. About 60 percent of the petroleum, 44 percent of the natural gas, and 57 percent of the gasoline and liquefied petroleum gases obtained from public and acquired lands during the year were produced under approved unit agreements.

On the Outer Continental Shelf, one unit plan was approved and none were terminated during the year. The total now stands at 15, embracing 348,253 acres.

On Indian lands, 10 new units were approved and 2 were terminated, the total number of plans in effect at the end of the year being 84, involving 161,306 acres.

Table showing supervised oil and gas activities, fiscal year 1962

LEASES AND WELLS UNDER SUPERVISION

Lands	Number of leases	Acres	Number of States	Wells studied	Wells completed	Completions productive ¹	Number of wells productive ¹	Total
Public.....	133,086	94,521,087	24	1,971	2,090	1,322	20,323	35,202
OCS.....	868	3,830,879	off 3	440	640	523	2,757	3,797
Acquired.....	6,793	4,734,169	30	81	85	25	406	1,079
Indian.....	11,167	4,105,308	16	507	496	347	7,063	11,832
Naval Petroleum Reserve No. 2.....	17	9,226	1	64	47	45	370	783
Military and miscellaneous.....	21	17,981	3	66	127	108	295	339
Total.....	151,952	107,218,650	-----	3,129	3,485	2,370	31,214	53,032

PRODUCTION, VALUE, AND ROYALTY

[Estimated]

Lands	Oil, barrels	Gas, 1,000 cubic feet	Gas, liquids, gallons	Value	Royalty
Public.....	168,173,000	544,816,000	397,335,000	\$535,084,000	\$70,038,000
OCS.....	71,227,000	411,702,000	0	294,806,000	51,609,000
Acquired.....	5,811,000	22,720,000	2,135,000	21,568,000	2,735,000
Indian.....	44,712,000	103,584,000	134,731,000	138,181,000	18,101,000
Naval Petroleum Reserve No. 2.....	4,129,000	6,143,000	13,567,000	14,954,000	2,044,000
Military and miscellaneous.....	2,000,000	471,237,000	41,474,000	15,320,000	2,621,000
Total.....	296,052,000	1,560,202,000	589,242,000	1,019,913,000	147,148,000

¹ Multiple completions (2 or more separately productive zones) are counted as separate wells.

NOTE.—Royalty figures do not include revenues from rentals and bonuses. Not included in the table, but also under supervision, are 1 salt, 5 sulfur, and 6 phosphate leases in the OCS. The salt and sulfur leases yielded about \$893,000 in royalties on production during the year.

There were 154 drilling units, or communitization agreements, approved during the year and 3 terminated, making a total of 1,338 in effect as of June 30. Eight development contracts were approved during the year and four were terminated. A total of 21 such contracts were in effect on June 30 involving 8,212,988 acres.

Connally Act Administration

The Connally Act of February 22, 1935, supports conservation activities of oil-producing States by prohibiting the interstate shipment of oil produced in violation of certain State oil and gas conservation laws. This act is administered by the Federal Petroleum Board at Kilgore, Tex., under supervision of the Geological Survey.

While the Connally Act is applicable wherever State laws limit the rate of production and prescribe conditions for producing and handling petroleum and its component parts, its chief application has been in the States of Texas, Louisiana, and New Mexico. The Board also enforces provisions of the act in Mississippi, Oklahoma, Arkansas, and Kansas. Violations of the Connally Act by producers outside designated areas have also been prosecuted and penalties imposed.

Unless exempted by the Board in writing and by notice, producers within designated areas are required to maintain and file correct and complete monthly and, as of January 15, 1962, semiannual reports. A separate report must be made by the operator for each pool or field.

At the beginning of the year, there were 15 cases of alleged violation of the act pending on the docket of the Board and 13 new cases were formalized during the year. Four cases, resulting in fines of \$8,650, were settled. At the end of the year, 24 cases were on the Board's docket.

Water Resources Division

The major objectives of this activity of the Geological Survey are to inventory the Nation's water resources and to make the information readily available in a useful form. The concept of a useful form changes apace with intensifying competition for water supplies, with increasing pollution of remaining supplies, and with growing awareness of conservation needs. Thermal pollution by industry, acid pollution from mining operations, flood plain zoning, and proper land use are modern problems which for their solution require water data—collected, analyzed, and presented in the comprehensive manner demanded by modern society.

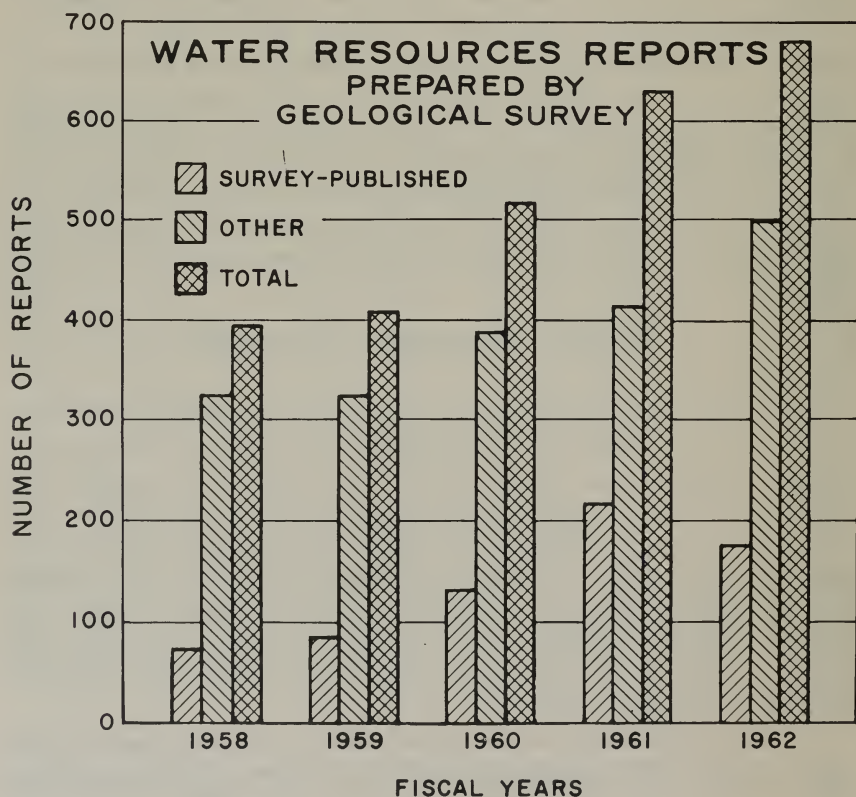
For man to maintain harmony with his water environment, he must know or learn the consequences of his activities and how to correct the imbalance which those activities impose on nature.

Interpretive studies and research are the new frontiers in water resources conservation. The breadth of knowledge necessary for the optimum planning of water projects comes only from properly interpreted basic data with research as the catalyst to convert water facts to water knowledge. As in other recent years, these objectives have provided the working philosophy of the Water Resources Division.

Water Resources Reports

Greater emphasis in recent years on utilization of water data in interpretive studies and on research activities as a source of new knowledge and improved understanding of processes in the hydrologic cycle was reflected in the type of reports processed and published during the year. The publication of basic facts was a significant segment of the work but a somewhat smaller percent of the total effort than in the past.

Requests received for water information have shown that the general public is becoming more conscious of water and water problems. To



fill the need of a wide audience of informed laymen interested in water management, several reports were prepared in nontechnical language.

These reports present complex concepts in a simple and easily understood way and supplement the more technical reports on hydrology, hydraulics, geochemistry of water, and other basic research.

Specific items of special interest were a report published on the use of water in the United States and a series of flood-inundation maps for the vicinity of Fremont, Calif., Harrisburg, Pa., Boulder, Colo., several areas in Ohio, vicinity of Chicago, Ill., and Atlantic City, N.J.

During fiscal 1962, the Survey prepared 107 water-supply papers, 17 circulars, 20 professional papers, 23 maps, and 3 bulletins concerning water. In addition, 73 reports were prepared for public reference and 425 reports were prepared for publication as cooperative State reports and as abstracts and articles in scientific journals.

State and municipal funds for cooperative water resources investigations

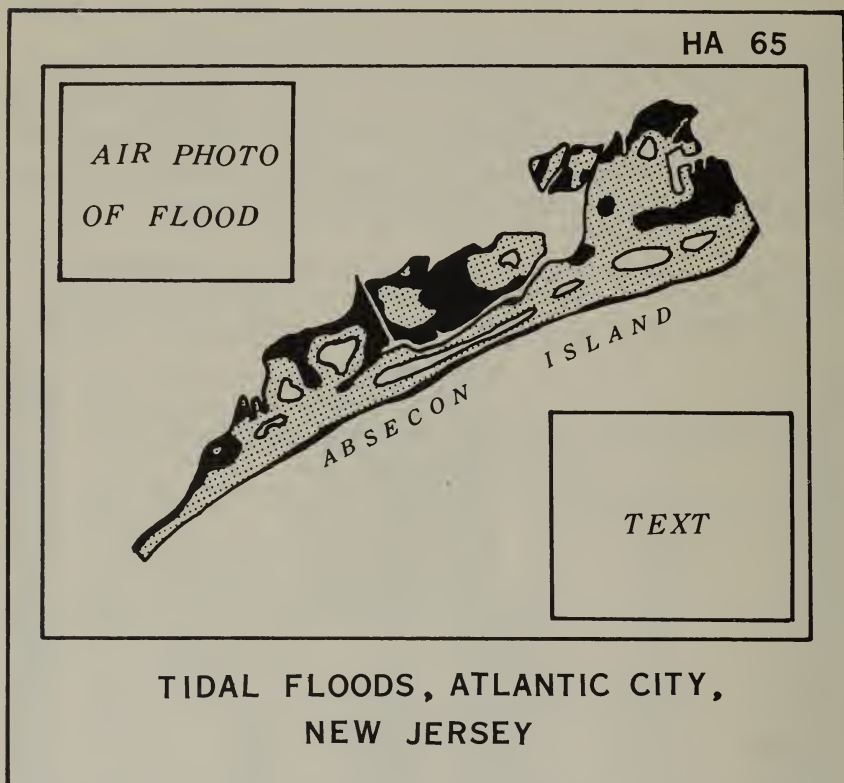
State	1962	State	1962
Alabama.....	178, 810	Nebraska.....	128, 237
Alaska.....	13, 083	Nevada.....	103, 575
American Samoa.....	5, 750	New Hampshire.....	30, 235
Arizona.....	264, 917	New Jersey.....	248, 846
Arkansas.....	106, 428	New Mexico.....	237, 137
California.....	786, 794	New York.....	382, 456
Colorado.....	227, 400	North Carolina.....	325, 127
Connecticut.....	74, 634	North Dakota.....	103, 594
Delaware.....	55, 848	Ohio.....	180, 898
District of Columbia.....	3, 078	Oklahoma.....	115, 121
Florida.....	385, 381	Oregon.....	140, 009
Georgia.....	187, 936	Pennsylvania.....	290, 738
Guam.....	16, 000	Puerto Rico.....	100, 501
Hawaii.....	218, 417	Rhode Island.....	35, 287
Idaho.....	108, 668	South Carolina.....	46, 524
Illinois.....	143, 293	South Dakota.....	89, 640
Indiana.....	201, 163	Tennessee.....	105, 388
Iowa.....	164, 760	Texas.....	533, 627
Kansas.....	250, 865	Utah.....	228, 376
Kentucky.....	167, 096	Vermont.....	11, 504
Louisiana.....	291, 368	Virgin Islands.....	10, 000
Maine.....	29, 314	Virginia.....	59, 279
Maryland.....	88, 644	Washington.....	295, 689
Massachusetts.....	83, 748	West Virginia.....	48, 414
Michigan.....	157, 860	Wisconsin.....	101, 616
Minnesota.....	130, 428	Wyoming.....	125, 156
Mississippi.....	91, 255		
Missouri.....	68, 158	Total.....	8, 656, 309
Montana.....	78, 239		

Surface Water Investigations

Streamflow and other surface-water data were obtained at 7,500 sites distributed throughout the 50 States, Guam, Samoa, and Puerto Rico. A special summary of streamflow records for the period 1888–1950 has been completed this year with publication of the report for Hawaii; summaries for all States have now been published. A similar summary for the period 1951–60 is currently in progress.

In its studies of floods, the Survey has prepared maps showing areas flooded in 8 cities in Colorado, Ohio, Pennsylvania and Cali-

fornia, and has in various stages of completion flood-inundation maps of 25 other metropolitan areas throughout the Nation. Studies of the magnitude and frequency of floods, by river basin, were completed for four major areas and work was started in four others. Flood-volume studies were made for more than 3,000 streams and reports were prepared describing floodflow characteristics at 109 bridge sites.



Sketch of a hydrologic atlas now in preparation. Map will show the areas flooded by the storm tides of September 1960 and March 1962 at Atlantic City and vicinity, New Jersey.

Research projects of special note investigated the relationship of low streamflow to the geology of the stream basin, developed instrumentation to measure turbulence in flowing water, studied time of travel of major streams to provide information on dispersion of pollutants, and evaluated the regimen of small detention reservoirs.



Aerial photo of the March 1962 floodtides at Ocean City, N.J. Hydrologic atlases for areas such as this are produced by the Survey, usually with Federal-State cooperative funds. The atlases are used for flood-mapping studies, engineering studies, et. {Photo furnished by the Philadelphia Evening Bulletin.}



A Geological Survey engineer uses a jeep-mounted crane with sounding weight and current meter to measure the flow of the Mississippi River at Vicksburg, Miss.

Ground Water Investigations

Ground-water studies are made to determine the source, movement, and discharge of ground water and of variations in its quantity and quality from place to place, and from time to time. The ground-water program also includes fundamental and applied research to develop geologic and hydrologic principles and techniques. During the 1962 fiscal year, work progressed on about 450 ground-water field projects and areal studies throughout the country. In addition to these, work also was conducted on 35 research projects.

Ground-water conditions were studied in areas ranging in size from the large Mississippi embayment area, covering all or part of nine States, to the small Point Arguello, Calif., missile base site. Desert valleys in Nevada were studied to provide the State with the information necessary to keep development consistent with available water.

Three of the 35 ground-water research projects are designed to increase the knowledge of the hydrology of different rock types.



A Geological Survey engineer determines the transmissibility of an aquifer in the Piedmont Province in Georgia by feeding water into a well at a constant rate and observing the change in water surface elevation.

Studies of the hydrology of basalt are providing information on the availability of water in much of Oregon, Washington, and Idaho. A project on the hydrology of permafrost regions will provide information about the unusual and difficult problems of water supply in parts of Alaska. Studies of the hydrology of limestone areas will be applicable throughout many parts of the country. Other research projects are aimed at determining the physical laws governing movement of ground water in order to advance scientific knowledge of the water-bearing properties of rocks.

Quality of Water Investigations

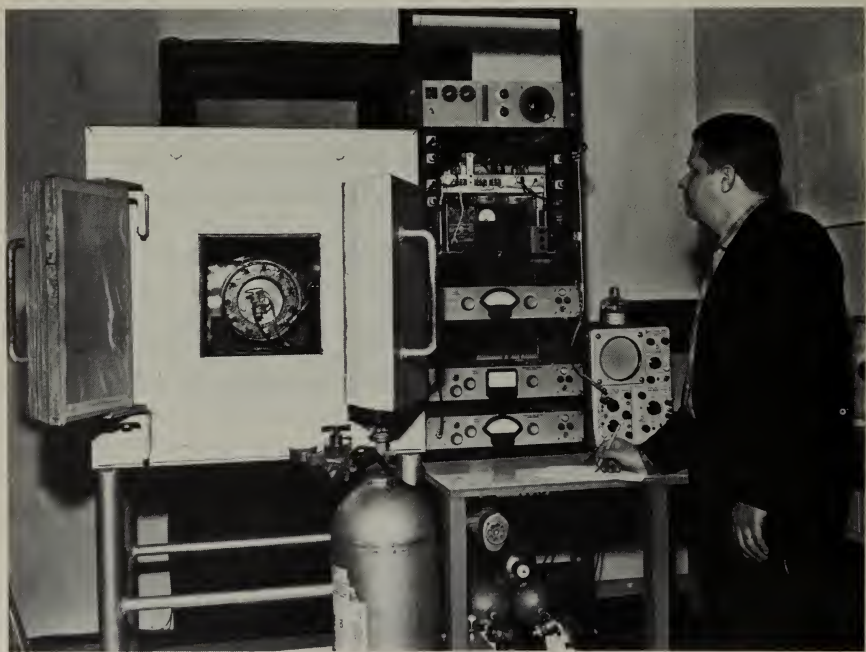
Water quality activities include basic and applied research, systematic collection, analysis and interpretation of chemical and physical characteristics of surface and ground waters, and the development of sampling, stream monitoring, and precision laboratory equipment not commercially available. Studies were made on a continuing basis in all major river basins throughout the conterminous United States, Alaska, and Puerto Rico, and the water quality of many smaller drainage areas is under investigation. Intensive studies of water-

borne sediments continued in the Potomac, Missouri, Middle Rio Grande, and Colorado Basins.

During 1962, a national network of 1,956 water quality stations was maintained with support from Federal, State, and municipal agencies. An evaluation of the sediment trapped in small reservoirs continued, in cooperation with the Soil Conservation Service.

Current research is directed to removal of radionuclides from water by earth materials; chemical reactions of radioactive substances; water quality controlled by weathering of clay minerals; effects of biological factors on the quality of surface waters; behavior of detergents and other pollutants in soil-water environments; occurrence and distribution of the rare halogens such as iodine, bromine, and fluorine; chemistry of atmospheric precipitation, geochemistry of iron, manganese, and aluminum in natural water; occurrence and distribution of minor elements in fresh and saline waters; roughness in alluvial channels; distribution and concentration of radioactive waste in streams by fluvial sediments; techniques for utilization of sediment reconnaissance data; and measurement of coarse fluvial sediment.

Reports of special interest released in 1962 include quality of surface waters of the United States; some observations on the hydro-



A research chemist has completed the measurement of tritium in a water sample and notes the pulses recorded from the radioactive hydrogen isotope.

chemistry and sedimentation of the Chamberlain Glacier area, Alaska; effect of depth of flow on discharge of bed material; inventory of published and unpublished sediment-load data, United States and Puerto Rico; effect of bed roughness on depth-discharge relations in alluvial channels; and hydrologic influences of strip mining. Reports describing the quality of surface waters of Alabama, Arkansas, Kansas, New York, North Carolina, Oklahoma, South Carolina, and Texas were prepared in cooperation with those States.

Soil and Moisture Conservation

Investigations to provide data for land conservation programs were continued in Nevada, New Mexico, Montana, Wyoming, and Utah. A project of intensive research on erosion was started in the basin of Warbonnet Creek near Harrison, Nebr. Included in this program is research on soil-plant-water relationships in arid environments.



Investigating permeability of range soils and relationships between moisture runoff, infiltration, and use by natural vegetation near Fort Peels, Mont.

General Hydrologic Investigations

An investigation is underway in the "prairie pothole" region of North Dakota to determine the amount of water evaporated from the water surface and transpired by different types of vegetation.

An investigation of the hydrologic effects of retarding reservoirs in the Sandstone Creek area of western Oklahoma was completed. Studies of stream morphology were conducted in environments ranging from the deserts of the Southwest to alpine areas of the Northwest.

The study of the use of water by saltcedar near Buckeye, Arizona, was continued in cooperation with the Department's Bureau of Reclamation. This project involves measurements of water used by the saltcedar growing in large tanks. A similar study on the use of water by willows, greasewood, rabbitbrush, and other local phreatophytes is being conducted in the Humboldt River Valley near Winnemucca, Nev. Several State and other Federal agencies are participating. A long-range, extensive study of water use by phreatophytes in the valley of the Gila River, Ariz., was started during the latter part of the year.

Geological Survey studies of South Cascade and Nisqually Glacier, Wash., are research efforts to gain additional insight into the relation of glaciers to climate. Data on hydrologic characteristics of glaciers are also being collected at Grinnel Glacier, Mont.



A dense growth of saltcedar in the Gila River valley, Arizona. This worthless phreatophyte uses large amounts of ground water which might otherwise be available to more valuable vegetation or for other uses.



Glaciological studies by the Water Resources Division of the Geological Survey are largely concentrated at the small, highly instrumented South Cascade Glacier in the rugged Northern Cascade Range, Washington.

Investigations at six established nuclear facilities were continued to determine the effect of disposal operations and to investigate techniques to decrease the possibility of adversely affecting water supplies. Investigations were continued at two existing and two planned sites for testing of nuclear explosives to determine effects of the testing on the hydrologic environment.

An adjunct to the disposal of radioactive wastes is the development of techniques for the use of radionuclides to implement hydrologic

investigations. The Survey is investigating, for the Atomic Energy Commission, the use of radioisotopes as tracers to determine the paths, rate, and quantity of water movement in streams and aquifers in areas where specific refinement of hydrologic knowledge is needed.

Foreign Hydrology Program

During the year, through the auspices of the Agency for International Development, 31 Geological Survey hydrologists worked overseas with 16 foreign governments. Survey hydrologists were assigned for short periods to Brazil, Egypt, Israel, Jordan, Nepal, and Panama to assist in the establishment of new or expanding water programs or to help in solving special problems. Long-term programs carried on in 14 countries included stream-gaging network programs in Afghanistan, Iran, Nepal and Turkey; hydrogeologic investigations in Chile, Egypt, Libya, Sudan, and Tunisia; hydrogeologic education in Brazil; and a water-management investigation in Pakistan with respect to waterlogging and salinity control in the Punjab region.

In the 16 host countries to which overseas Survey personnel were assigned, more than 200 nationals were given technical hydrologic training and guidance. In addition, 57 individuals from 24 foreign countries were given training in the U.S. field offices of the Water Resources Division.

Topographic Division

The Survey's Topographic Division as its major function prepares and maintains the national map series covering the United States, its possessions and territories. This series is a fundamental part of the effort required to effectively inventory, develop, and manage the resources of the country.

Other functions are the production of related maps and other publications as necessary in the national interest; periodic revision and maintenance of all maps and publications; and the improvement of map products, operational techniques, and instrumental equipment through research and development. Information to Government agencies and the public concerning all available map products resulting from the surveying and mapping activities of the Federal agencies is furnished by the Map Information Office.



Field surveying operations are expedited greatly by transporting engineers and equipment by helicopters over rugged terrain.

Surveying and Map Preparation

Of the total area of the 50 States, Puerto Rico, and Virgin Islands, 63 percent is covered by topographic surveys at scales of 1:24,000 and 1:62,500 (Alaska, 1:63,360). These surveys have been published as standard quadrangles for 55 percent of the total area. Advance copies, prior to map publication, of topographic surveys for the other 8 percent are available upon request.

During fiscal 1962, 468 maps of unmapped areas equivalent to 1.3 percent of the total area were published. Another 0.6 percent heretofore covered by 15-minute maps (1:62,500) at obsolete standards was replaced by 386 new maps at 7½-minute standards (1:24,000).

During the year, 59,300 square miles of 7½-minute mapping were added to the growing backlog of these maps which are 10 years old and which probably require revision. In 1962 the backlog of revision was diminished by 11,300 square miles; leaving 272,600 square miles of 7½-minute mapping requiring revision.

In addition, numerous special maps were published for various purposes such as research, administration, or information. In co-

operation with the Department's National Park Service, cartographic compilation of shaded-relief maps were prepared for Lassen, Olympic, Rocky Mountain, Wind Cave, Yellowstone, and Yosemite National Parks.

One base map was completed for the State of Washington. Urban-area maps were completed for the metropolitan areas of Pittsburgh, Pa., and Milwaukee, Wis.

The following table is a detailed summary of map publication during fiscal 1962:

Number of maps published during fiscal year 1962 and areas surveyed to produce these maps

	Area (sq. miles)	Number of maps	
		7½-minute	15-minute
LARGE SCALE MAPS			
Standard quadrangle maps:			
New:			
Mapped at 1:24,000 scale standards.....	31,006	345	56
Mapped at 1:62,500 scale ¹	14,419		67
Replacement of 1:62,500 maps by mapping at 1:24,000 standards.....	22,232	383	3
Revised.....	12,542	203	5
Reprinted without revision.....		273	300
Special editions:			
Series conversion.....	14,214	10	60
Scale conversion.....	13,314	184	15
Total large-scale maps.....	107,727	1,398	506
			Number of maps
SMALL SCALE AND SPECIAL MAPS			
New maps:			
Urban area.....			2
National parks and monuments.....			4
1:250,000 scale.....			42
Shaded relief.....			15
State base.....			1
Antarctica.....			3
Map revision:			
1:250,000 scale.....			13
Topographic indexes.....			86
Reprinted.....			126
National park and monuments.....			1
Total small-scale and special maps.....			293
Total maps.....			2,197

¹ Includes 1:63,360 mapping, Alaska only.

National Atlas Project

During this year, the Geological Survey began the planning of a national atlas. The atlas will be a compilation of maps useful to Government agencies and officials, business and industrial establishments, educational institutions, and libraries; and will not compete with standard, largely geographic atlases and map collections issued by commercial publishers.

In general, 150 or more subjects to be included in the national atlas will fall into four categories: (1) Introductory material; (2) physical maps; (3) economic maps; and (4) cultural maps. Production of the atlas will start in fiscal 1963.

Training Program

The Geological Survey, in cooperation with the Agency for International Development (AID), extends technical assistance to many nations. During fiscal 1962, technical training was provided by the Topographic Division to representatives from Brazil, Chile, Colombia, El Salvador, Egypt, Indonesia, Ethiopia, Pakistan, Philippines, and Sudan. Two technical experts are being furnished to AID for extended periods in connection with the mineral exploration program in Pakistan.

Antarctica Mapping

Topographic mapping in Antarctica was conducted as part of the U.S. Antarctic research program of the National Science Foundation. During the 1961-62 austral summer, six engineers were assigned to the Antarctic area to establish geodetic control for mapping, using methods that combine triangulation with solar and daylight stellar observations. Electronic distance-measuring equipment was used by



Aerial view of a tent camp on the Ross Ice Shelf, used by Survey engineers engaged in mapping operations in Antarctica.

a three-man helicopter-supported party to establish geodetic control on 100,000 square miles of mountainous terrain.

Stellar observations for geodetic position were made at the marker designating the South Geographic Pole, and at the new Byrd Station.

About 105,000 square miles of aerial photography were obtained by U.S. Navy Air Development Squadron Six (VX-6). A Survey photoliasion technician was assigned in an advisory capacity to the Squadron's photographic laboratory in Christchurch, New Zealand, to insure that mapping-quality photography was obtained. Topographic maps in shaded-relief editions were published of the coast of Wilkes Land and of the Sentinel Range of the Ellsworth Mountains. Mapping is in progress for the Horlick Mountains, Executive Committee Range, McMurdo area, Britannia Range, Queen Alexandra Range, the Heritage Range of the Ellsworth Mountains, and of part of the Pensacola Mountains. The Geological Survey continued to serve as the U.S. Antarctic Map and Aerial Photography Library and provided consultant services to scientific and technical visitors.

Research and Development

All major phases in the preparation of topographic quadrangle maps benefited by research and development in the Topographic Division during 1962.

To provide guidance for this research effort and to evaluate procedures, standards, and instruments, the Division carries on an accuracy testing program. In this program a representative 10 percent of the quadrangles are tested by special surveys for both position and elevation accuracy. The tests are designed to give results that can be subjected to statistical analysis. The evaluated test findings are an important aid in selecting optimum methods for new mapping, in designing research in operations, and in formulating standard procedures.

Long-range research has been devoted to improving the basic information content of topographic maps by addition of photoimagery, and to producing map supplements or map substitutes based on orthophotography in various forms.

Truck-mounted surveying tower.—Lightweight, portable towers for control surveys designed by engineers of the Topographic Division are triangular in cross section, and weigh approximately 5 pounds per foot of height. The height may be varied from 14 to 74 feet in 6-foot increments. Each unit consists of an outer tower to support the observer, and an independent inner tower to support a surveying instrument. The towers can be transported assembled as a trailer. In recent experience, for reconnaissance, 36- and 50-foot towers have

been mounted on pickup trucks. Truck-mounted towers, with outriggers and a winch, can be erected by one man in less than 15 minutes, saving considerable field time in selecting station sites.

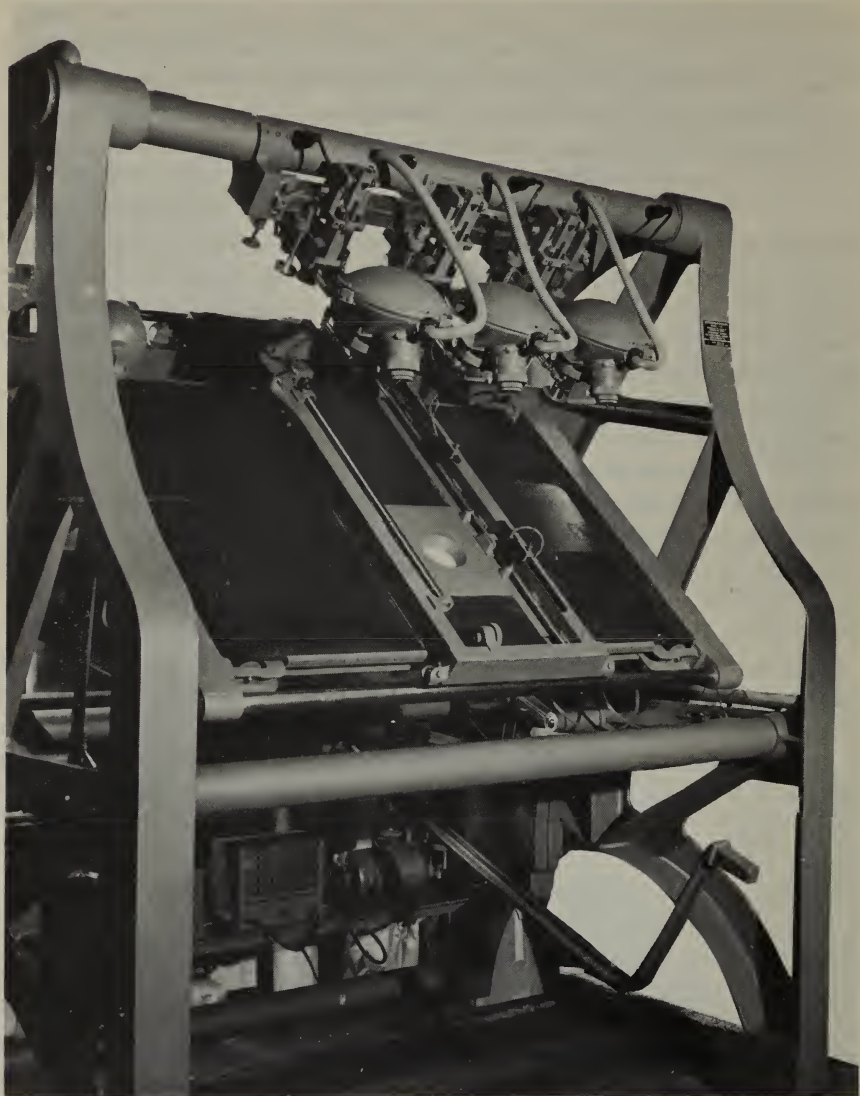
Position from star observation in Antarctica.—During the summer of 1961 studies were undertaken to improve star observing techniques and to evaluate the azimuth method of geographic position determination. The method appeared applicable to determining positions in Antarctica where previous positions based on altitude measurements of the sun were influenced by the effects of uncertain variable refraction. During the 1961–62 season, daylight star astronomic observations based on both azimuth and vertical angle measurements were made at eight Antarctic stations. In addition to providing data on the effect of vertical refraction, it may be possible to use the separate solutions to evaluate the relative merits of the altitude or azimuth methods.

Visual fatigue in photogrammetric operations.—A pilot study of the visual problems of 10 selected stereocompilers, conducted in the Rocky Mountain area office in 1958–59, showed that visual refractive corrections and improved ambient illumination conditions resulted in generally improved operator efficiency. A second project involving 60 Rocky Mountain area stereocompilers is in progress.

Map-photograph combination.—For some purposes aerial photographs are superior to maps because of the wealth of fine detail they contain. But they have two disadvantages—their scale is not uniform, so they cannot be used directly for measuring distances and areas, and the large amount of detail shown by fine tonal graduations makes them difficult to interpret. An ideal product would be a combination map and photograph, which would have reliable scale and readability of a map, and the complete detail of the aerial photograph. Research in the Topographic Division extending over several years holds promise for the economical production of such a combination.

The production of uniform-scale photographs (orthophotographs) is now practical by means of the orthophotoscope. The model T-61 orthophotoscope, the third of a series of such instruments, was completed in prototype form in 1961. It produces satisfactory orthophotographs from most mapping photography. Operation testing and design refinement of the T-61 are now underway. Studies are in progress on scribing on orthophotographs, and on various techniques for processing orthophotographs to produce map substitutes.

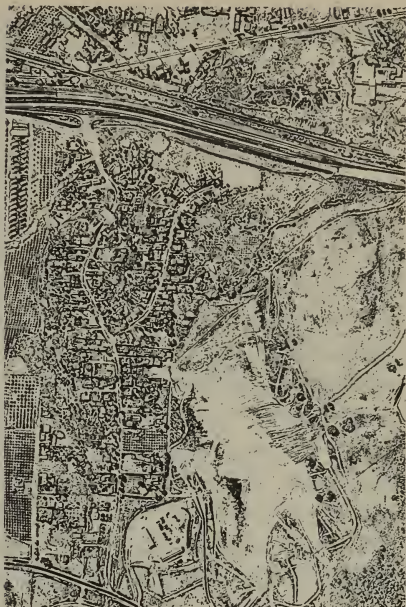
As a means of improving the legibility of aerial photographs, a photolaboratory technique has been developed called edge isolation. In this procedure a film positive or print is produced that has extremely opaque image edges, with other tonal graduations suppressed. The edge-isolated print is made by a semiautomatic two-step process using the infrared quenching action of a photographic contact printer.



Orthophotoscope Model T-61

When the original is an orthophotograph, the edge-isolated print shows buildings, roads, woodland, and other features by line images in true position. Patterns useful to geologists and photointerpreters are often more easily identified than on a continuous-tone print.

The combination of orthophotography and edge isolation may lead to economical production of a new type of map or map substitute.



Comparison of normal and edge-isolated aerial photograph. In the print at the right, buildings, roads, trees, and other features are shown as line images instead of continuous tones. This photographic technique is a means of producing quickly a useful map substitute.

Map Information Office

Facilities for supplying information on maps, aerial photography, and geodetic control surveys to Federal, State, and local government agencies and to the public are maintained at the Map Information Office in Washington and at the Division's area offices. Services include over-the-counter map sales for the convenience of the public, commercial firms, and Government agencies; sales of prints of advance materials from current topographic mapping and photostats of out-of-print maps; graphic or tabular assemblies of map, photographic, and geodetic control information.

The 10th edition of the index map, "Status of Topographic Mapping in the United States," was published in two sheets. The new edition shows by color pattern the scale and evaluation of the topographic maps available for the States, Puerto Rico, and the Virgin Islands, and delineates the areas in which new mapping is in progress.

Material was assembled for the 12th edition of the index map, "Status of Aerial Photography," and the 8th edition of the index map, "Status of Aerial Mosaics." The new editions will show all areas known to have been photographed and those for which aerial

mosaics or photomaps are known to have been compiled by Federal, State, and commercial agencies.

A supplement to the aerial photography index map for the calendar year 1961 was prepared for administrative use. This index map shows areas for which photography was contracted or delivered during the year.

Twenty-three sheets in the 1:250,000-scale series of geodetic control diagrams were published in cooperation with the Coast and Geodetic Survey. These diagrams show the location of horizontal and vertical control surveys and provide information essential to planning topographic mapping projects, to engineers establishing electronic transmission facilities, to land surveyors making connections to the Federal net, and to those engaged in scientific investigations.

During the year, many inquiries pertaining to maps showing Civil War battlefields were received. In order to service these requests, as well as to make such information readily available, a bibliography of Government maps and charts covering areas in which the major battles of the Civil War took place was published as Circular 462.

Publications

The results of research and investigations by Geological Survey scientists and engineers, both in the field and in the laboratory, are made available to the public through a variety of reports and maps. Of the formal reports published by the Survey, books are printed by the Government Printing Office and maps are printed in the Survey's own plant.

During the past fiscal year, 216 technical book reports were published. Printed maps totaled 2,810, of which 1,950 were new and 860 were reprints. The 2,810 maps comprised nearly 7,980,000 copies that ranged in size from 17 by 21 inches to 50 by 72 inches.

Kind of maps	Number of maps printed
Topographic maps:	
Standard.....	2, 197
Other ¹	95
Geologic maps:	
Geologic quadrangles and miscellaneous investigations.....	82
Mineral resources.....	34
Geophysical investigations.....	43
Conservation maps: River surveys.....	13
Water resources maps: Hydrologic atlases.....	12
Maps for inclusion in book reports.....	223
Maps for other agencies.....	111
Total.....	2, 810

¹ Includes experimental printings and other miscellaneous maps.

Geological Survey maps are distributed by mail from bulk stocks at Silver Spring, Md., Denver, Colo., and Fairbanks, Alaska. Over-the-counter map sales are made at these and 13 other Survey offices. In addition, 561 commercial agents throughout the United States sell these maps to the public.

In addition to approximately 43,500,000 maps, books, and pamphlets on hand at the beginning of the year, 7,266,000 copies were received of new and reprinted maps, as well as 382,000 copies of reports. Distribution of 4,691,000 copies of maps was a substantial increase over last year's comparable figure of 4,544,000. Approximately 307,000 book reports and pamphlets, 139,000 copies of the Survey's monthly announcement of new publications, and 245,000 topographic map descriptive folders and symbol sheets also were distributed during the fiscal year.

The total distribution was implemented by 250,000 individual orders. Sale of maps to the public brought in \$688,569.87, which was deposited to miscellaneous receipts in the U.S. Treasury. All the book reports distributed by the Survey and 24 percent of all maps were provided free for official and educational use. General distribution of Survey book reports to the public is through sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

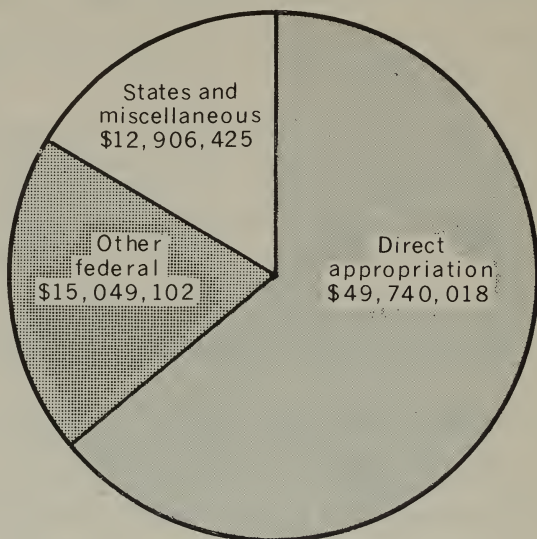
The number of publications distributed by the Geological Survey during fiscal 1962 as compared to last year is shown in the following table:

	Maps, map indexes, and book reports		Increase or decrease (percent)
	Fiscal year 1961 ¹	Fiscal year 1962	
Washington.....	2,578,100	2,864,350	+11
Denver.....	1,854,800	1,675,750	-10
Fairbanks.....	45,200	43,050	-5
Other offices.....	368,200	415,350	+13
Total.....	4,846,300	4,998,500	+3

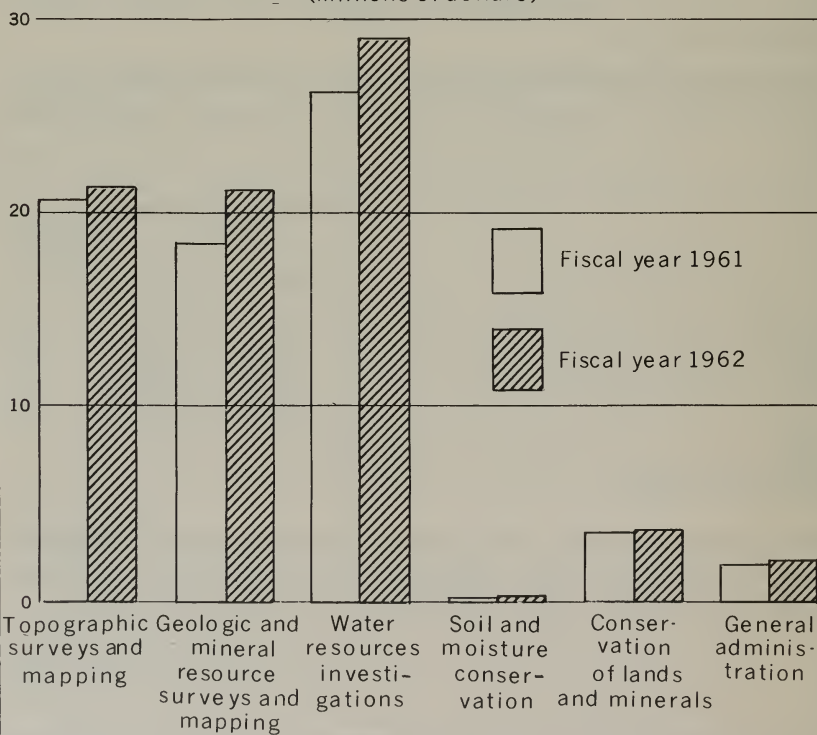
¹ Quantities revised downward, by exclusion of symbol sheets and descriptive folders, for comparison with new reporting procedure.

During fiscal year 1962 the Geological Survey incurred obligations totaling \$77,695,545. The following charts illustrate the total funds by source and budget activity.

TOTAL FUNDS BY SOURCE FY 1962



COMPARISON OF FUNDS BY ACTIVITY
(Millions of dollars)



Bureau of Mines

Marling J. Ankeny, *Director*



American technology advanced rapidly on many different fronts during the 12 months comprising the 1962 fiscal year. This swift progress frequently emphasized past accomplishments of the Department of the Interior's Bureau of Mines and, just as frequently, established new and challenging future goals for the Bureau's scientists and engineers.

Titanium metal and helium, both available today as a result of Bureau efforts, played essential parts in the Nation's space achievements. Progress was made in research to improve the mining, processing, and utilization of coal. Iron- and steel-making technology was advanced. New gains were made in Bureau programs to develop methods for producing high-purity metals, and substantial additions were made to scientific knowledge about the fundamental properties of many different minerals and fuels.

However, even as methods and materials were being developed in Bureau laboratories to meet present needs, innovations in engineering technology created demands not only for more of the mineral products that already are available but for materials to satisfy exacting specifications and to meet requirements that did not exist a short time ago.

As the year ended, it was clear that conservation and development of America's mineral resources, and those of the free world, is a task more difficult, more challenging, and more vitally important than it has ever been.

Helium

Large-scale conservation of the Nation's irreplaceable helium resources moved closer to reality with the award of long-term helium purchase contracts to four private companies.

Under these contracts, the companies are to finance and build, and will operate, five plants to recover helium from certain natural gases serving fuel markets. During the 22-year life of the purchase agreements, about 62.5 billion feet of helium will be purchased by the Government and stored underground until needed in the future or sold by the Bureau of Mines to meet current demands. In this way, waste of a limited and irreplaceable resource will be reduced, and helium will continue to be made available for important uses in many areas of science and industry.

Award of the four contracts utilized all of the \$47.5 million-a-year contracting authority granted by the Congress for the program. Additional details about the four contracts are shown in the table that follows.

Summary of Bureau of Mines contracts with private companies for the acquisition of helium for conservation

Company (and parent companies when applicable)	Plant location and date of contract	Initial unit price (for 1,000 cubic feet)	Maximum annual obligation (millions)	Estimated helium volume (million cubic feet)	
				Annual average	Life of contract
Helix Co. (Northern Natural Gas Co.)	Bushton, Kans., Aug. 15, 1961.	\$11.24	\$9.5	675	13,500
Cities Service Helix, Inc. (Cities Service Co.)	Ulysses, Kans., Aug. 22, 1961.	11.78	9.1	610	12,200
National Helium Corp. (Panhandle Eastern Pipe Line Co. and National Distillers and Chemical Corp.)	Liberal, Kans., Oct. 13, 1961.	11.78	15.2	1,053	21,060
Phillips Petroleum Co.	Sherman County and Dumas, Tex., Nov. 13, 1961.	10.30	13.7	788	15,766
Weighted average or total		11.29	47.5	3,126	62,526

Construction of the main section of a 427-mile pipeline system to transport crude helium (a mixture of about 60 percent helium and 40 percent nitrogen) from industry's plants to the Government's Cliffside field near Amarillo, Tex., was 90 percent complete on June 30, 1962. The pipeline system, costing about \$8.5 million, will be operated by the Bureau.

The helium conservation program is required by the Helium Act of 1960 to be self-liquidating, and to meet this requirement, the price of helium sold by the Bureau of Mines was increased to \$35 a thousand cubic feet f.o.b. Bureau plants. Even so, expenditures will exceed income from sales during the early years of the program. Additional funds are to be obtained as necessary, through borrowing as authorized by the Congress. Borrowing of \$10 million was authorized without fiscal year limitation but was not used in 1962 because none of the new plants were completed and no helium was purchased.

Additional borrowing authority will be included in future budget requests.

In response to continued increases in helium demand during fiscal 1962, the Bureau of Mines shipped 588 million cubic feet of the lightweight element; about 76 percent of this went to Federal agencies. Production of helium at the five plants operated by the Bureau exceeded demand by nearly 147 million cubic feet. The excess was stored underground for future use, increasing the total in underground storage to 566 million cubic feet.

A helium plant with a capacity of 65 million cubic feet a year, built by Kerr-McGee Oil Industries, Inc., of Oklahoma City, Okla., began producing and marketing helium from the Pinta Dome field in eastern Arizona during November 1961. This operation, not a part of the Government helium conservation program, is the first private venture into helium production since the 1930's.

Helium continued to play important roles in rocket, missile, and space programs, nuclear reactor development, shielded-arc welding, metallurgy, low-temperature research, and medical and scientific studies.



At the recently established Helium Research Center near Amarillo, Tex., Bureau of Mines scientists are conducting fundamental studies to obtain more knowledge about the properties of helium and the natural gases that contain it.

A helium research program was conducted as an integral part of the helium conservation program at the recently established Helium Research Center in Amarillo, Tex. Besides conducting studies to develop and improve techniques for extracting and saving helium, scientists at the center perform fundamental investigations to learn more about the properties and uses of this remarkable element. Such research helps assure that the conserved helium will be used wisely and effectively to further scientific progress and to advance the national economy.

Petroleum, Natural Gas, and Oil Shale

Development and efficient use of the Nation's petroleum and natural gas resources were promoted through many Bureau of Mines scientific, engineering, and factfinding programs in fiscal 1962. Research to increase technical information on oil shale was also conducted to assure a firm basis for commercial development when this resource is needed.

New information on detrimental substances in petroleum was gained when 12 additional sulfur compounds were identified in Wasson, Tex., crude oil and 8 in Wilmington, Calif., crude oil. Some 94 such identifications have now been made. Sulfur-concentrate fractions were prepared from a sample of "deasphalted" Wasson crude oil residue, providing six samples for further study. All will be screened by the National Institutes of Health for possible cancer-causing characteristics.

Improvements during the year in a Bureau catalytic microhydrogenation technique—developed for analyzing trace components in petroleum—advanced the sulfur project alone by at least 2 years beyond the stage that would have been possible with older methods. Other advances in analysis included improved chromatographic techniques that make it easier to separate sulfur compounds from various mixtures. About 45 sulfur-containing compounds were synthesized during the year, and one standard sample was purified, bringing the total number of standards to 42. A low-temperature zone-melting unit capable of performing at -100° C extended considerably the operating versatility of the purification technique.

Nitrogen Compounds Identified

A special distilling process was used in laboratory research on separating and identifying harmful nitrogen compounds that present a major problem in utilization of low-grade crude oils.

Fundamental studies with a constant-volume combustion bomb yielded data on ignition delays for eight normal paraffins and eight olefins. Good correlations were obtained in several different treatments of the data, suggesting a close relation to physical laws governing combustion processes.

Petroleum-product survey reports again provided semiannual data on motor gasolines and annual data on aviation, diesel, and burner fuels marketed in the United States. Obtained by the Bureau through industry's cooperation, this information guides the petroleum industry in planning its refining operations, aids the automotive industry and manufacturers of burner equipment in design problems, and assists consumers in selecting and using petroleum fuels.

Chlorinated Petrochemicals Studied

During the year, basic studies in thermodynamics yielded new data used in research and for designing and developing industrial processes. Chlorinated petrochemicals were studied with the Bureau's method of rotating-bomb calorimetry to provide data for civilian and defense applications. A modified combustion bomb featuring tantalum linings and fittings was perfected. Platinum lining—ordinarily used when the combustion reaction has corrosive products—is not suitable for certain compounds because surface catalysis leads to unwanted side reactions.

Use of sodium tripolyphosphate (STP) to aid oil recovery by increasing injection rates in waterfloods continued to grow during the year. Two papers describing the Bureau's development and use of this material were published. Several major phosphate-producing companies now perform their own field tests with this chemical. One firm initiated a large-scale marketing program—using nationwide advertising and special packaging of STP for the petroleum industry—that acknowledged the Bureau's research.

Calculations and predictions concerning various other secondary-recovery methods were made, and three articles on Appalachian region oilfield reservoirs were published. This information assisted eastern oil operators, especially in the Pennsylvania Grade crude-oil area, to establish additional secondary-recovery projects and thus increase total recovery of the area's high-quality crude oil.

Computers Aided Oil Conservation

Computer methods for forecasting future performance of complex petroleum reservoirs were published as an aid in conserving oil reserves. These reports are concerned with unsteady state and two- or three-phase flow in reservoirs in complex geometry.

Extensive laboratory permeability tests with water-plugged sandstone cores showed that water blocks in gas wells can be removed efficiently with detergent solutions in isopropyl alcohol. A field test of the alcohol-surfactant method of removing water blocks demonstrated the applicability of the treatment by causing an increase in the gas produced from a 12,000-foot well in Pecos County, Tex.



Different components of shale oil are separated from one another in this apparatus at a Bureau of Mines research center.

A comprehensive study was begun of the magnitude of chemical wastes and oilfield brines, and of methods used to dispose of them by injection into permeable formations. Complete geologic and engineering data were obtained on 16 chemical-disposal operations, principally in the South-Central, Southwest, and Gulf States, and in Michigan.

An analytical method for studying thermal degradation of oil shale, developed by the Bureau, and described in one of its publications during the year, permits accurate determination of the distribution of organic elements in thermal-degradation products, facilitating characterization of different oil shales. A total of 51 sample sets providing comprehensive sampling of oil-shale deposits at specific locations was obtained from private companies and from Government agencies during the year. These samples, representing shales mostly of the Green River formation in Colorado, Utah, and Wyoming, will provide much new knowledge about the oil-shale resources of this country.

The Bureau continued to provide the Oil Import Administration with reliable petroleum statistics to help it formulate policy and administer controls. Bureau forecasts, one prepared annually and two twice yearly, were used to determine crude and product import quotas. In all, 120 statistical reports on petroleum and natural gas were published during the year.

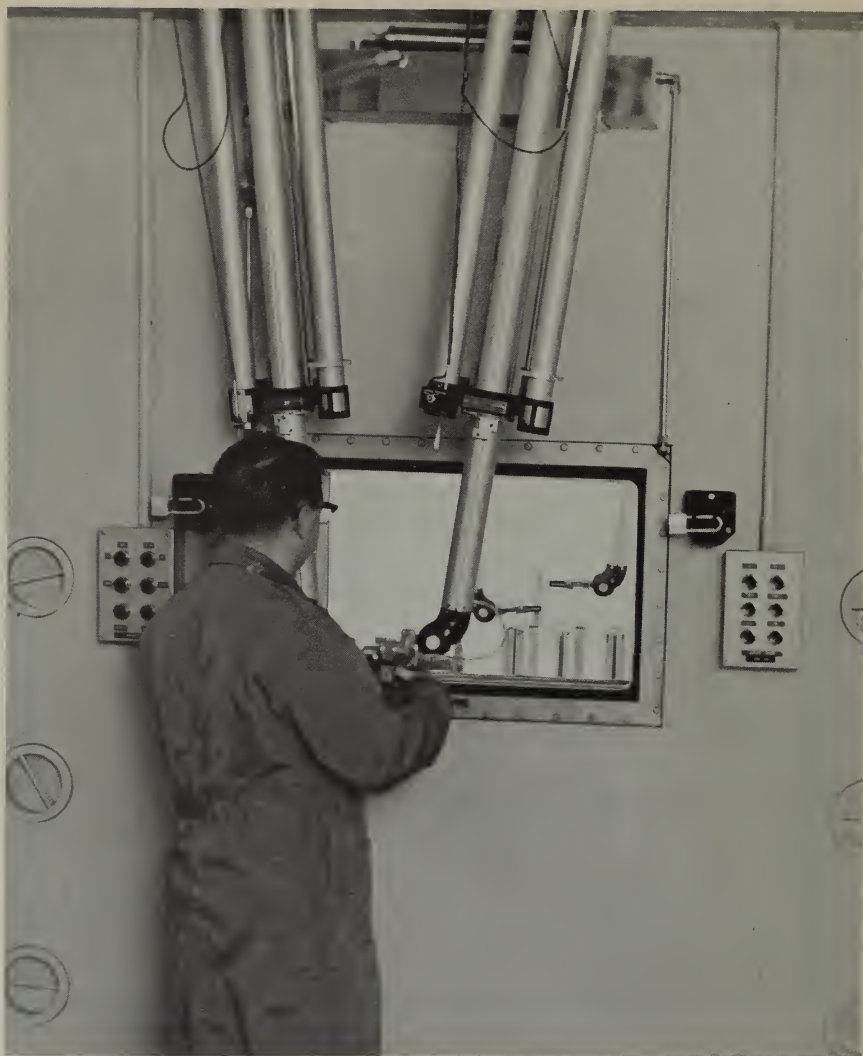
Minerals Development

Improved techniques for processing and utilizing the Nation's extensive low-grade iron ore resources, greatly expanded mining research, and a continued search for better metals, alloys, and compounds for use in missiles and space exploration highlighted Bureau programs for metallic and nonmetallic minerals in fiscal year 1962.

A high-intensity gamma-irradiation (cobalt 60) facility, the largest of its kind for mineral studies in the United States, was built and placed in operation during the year at the Albany, Oreg., Metallurgy Research Center.

New Pellets for Blast Furnace Made From Low-Grade Ores

Outstanding success was achieved toward the end of the fiscal year in one phase of the Bureau's iron ore program when a new blast-furnace feed, prepared with techniques developed at the Bureau's Minneapolis, Minn., Research Center and averaging about 80 percent iron, was tested in the experimental blast furnace at Bruceton, Pa. Made from Lake Superior taconite and prereduced with North Dakota lignite, the pelletized feed made possible the highest produc-



A technician operates the controls of a master-slave manipulator in the Bureau of Mines new cobalt 60 radiation cell. This unit, activated during the year, will be used in studies to determine the effect of radiation in improving minerals and fuels technology.

tivity and lowest fuel-consumption rates ever recorded in operating the experimental furnace. The methods used in preparing the pellets may ultimately contribute to economic processing of the Nation's vast reserves of nonmagnetic taconite.

An earlier achievement, pioneering injection of supplementary fuels into blast furnaces, received industrywide recognition when

Bureau scientists were awarded a certificate of special merit by the American Iron and Steel Institute.

In addition to its use for comparing and evaluating raw materials, the Bruceton furnace was used extensively in developing new and more efficient operating procedures. Theoretical studies of the blast furnace continued as preliminary calculations were completed on an analog-computer simulation of its operation.

Iron Ore Flotation Method Improved

The flotation method developed earlier for concentrating nonmagnetic taconites and semitaconites was improved. In the Bureau procedure the silica gangue material is floated away from the iron minerals. In another technique investigated during the year, the nonmagnetic iron minerals were converted, through reductive roasting, to magnetic minerals and then concentrated magnetically.

Continuing investigations into the physical chemistry of steel-making included work on high-temperature reactions, depleted uranium as an alloying element in steel, use of gaseous oxygen for the partial refining of molten pig iron, addition of rare earths to improve the high-temperature properties of alloy steels, and effectiveness of radioisotopes for identifying phases in steel.

Hot-Twist Steel Test Published

Evaluation of hot-working characteristics of steel by novel "hot-twist" testing techniques was described in one Bureau report, while another described the use of titanium as a substitute for manganese in steel. In addition, comprehensive materials surveys were published on cobalt, kyanite, lithium, and vanadium.

Relationships between damping capacity (internal friction that slows vibrations), internal structure, and magnetic and physical properties were determined and published for high-damping manganese-copper alloys containing from 60 to 85 percent manganese. These investigations continued to stimulate interest in industry and among physicists concerned with problems of vibration in metals.

In an experimental 20-inch-diameter shaft furnace, manganese minerals from a Minnesota brown ore were converted to water-soluble sulfate. A patent was issued for the rotary leaching drum used to extract the manganese salt. Feasibility of the inverse solubility method for recovering manganese sulfate from solutions was demonstrated, suggesting the possibility of lower costs and better operating procedures than those anticipated for evaporation methods.

Basic Information Obtained on Tungsten and Chromium

Tungsten and chromium research in fiscal 1962 was concerned mainly with developing fundamental scientific data, improving processing techniques, and broadening the utilization of low-grade ores. The Bureau's basic studies in vapor deposition of tungsten led more than 20 industrial firms to engage actively during the year in developing applications for the vapor-deposition process. Some high-temperature applications of tungsten metal and alloy were studied intensively to form a basis for systematically exploiting their usefulness in modern metallurgy.

Initial success with fluidized-bed techniques for coating small particles of refractory oxides with tungsten may ultimately provide new materials for use at elevated temperatures. Improved techniques were sought for preparing tungsten metals and compounds and for producing ultrapure tungsten and chromium metals. Promising methods for using domestic low-grade ores of tungsten were pursued, while successful tests indicated the technical feasibility of using domestic chromite resources to produce ferrochrome.

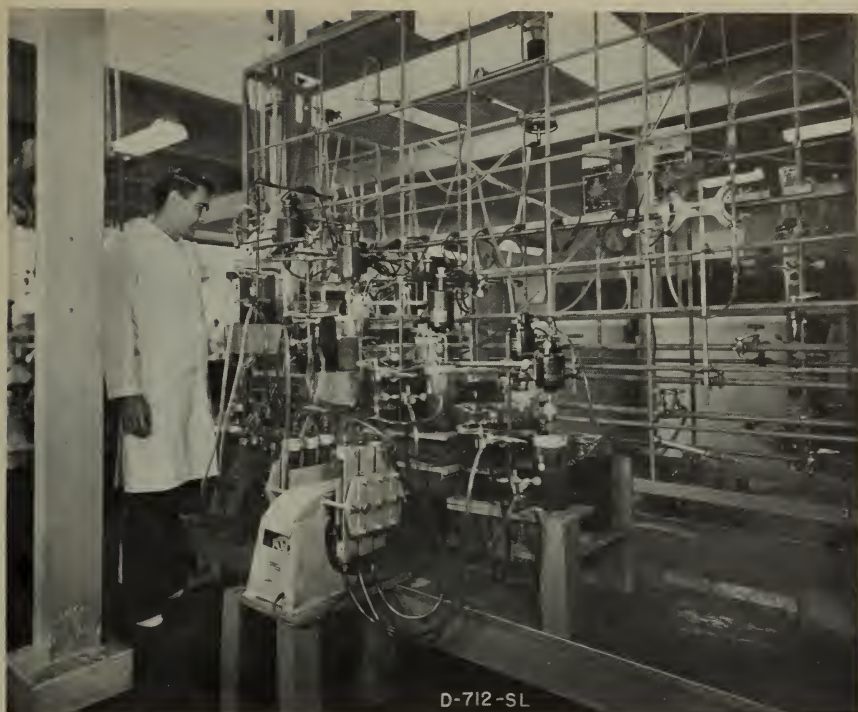
Reliable analytical methods for determining minute constituents of high-purity metals and compounds were developed, and procedures utilizing complex, modern analytical instruments were described by the Bureau. The effectiveness of the electron-probe X-ray spectrograph was increased by installing vacuum spectrometers that extended its measurement range. Small concentrations of aluminum, phosphorus, and calcium in various materials were determined.

Bureau laboratory research was successful in developing techniques for producing high-purity ductile molybdenum metal, and Bureau chemists developed an X-ray fluorescence method for analyzing tungsten and molybdenum metals and electrolytes.

High-Purity Nickel Produced

Commercial-size electrolytic starting sheets of extremely pure nickel were produced from crude nickel with a Bureau-developed electrolytic-solvent-extraction process. The sheets contained less than 2 parts per million of cobalt, a much lower value than any electrolytic nickel available commercially.

High-purity vanadium metal also was obtained, utilizing bomb-reduction and electrefining techniques. A method developed earlier for reducing vanadium metal from vanadium pentoxide in an open vessel was successfully scaled up to produce 15-pound ingots, and vanadium-titanium and vanadium-aluminum-titanium alloys were made by continuous open-vessel reduction.

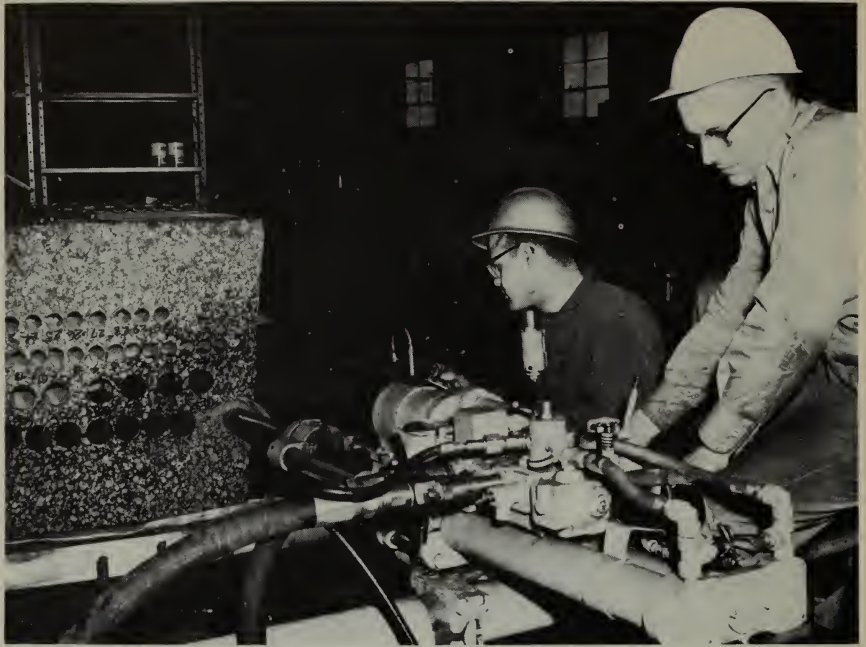


This Bureau metallurgist is separating cobalt from a nickel solution before the solution is processed electrolytically to obtain a high-purity nickel metal.

The Bureau's research in physical chemistry continued to provide basic thermodynamic data, essential to scientific progress, on heat capacity, heat of formation, entropy, and other properties of metals and compounds. Reports were published on the thermodynamic properties of many minerals and metals, including scandium, antimony oxides, sodium molybdate and tungstate, strontium bromide and nitrate, zirconium fluoride and sulfate, calcium vanadate, sodium- and calcium-alumina silicates, erbium, and bismuth and cerous chlorides. In addition, as a result of public demand, the Bureau combined and republished four of its earlier Bulletins on theoretical metallurgy.

Mining Systems Analyzed

Research on mine-systems analysis advanced as industrial engineering principles were applied to operational problems. Studies to develop permissible angles for slopes of open-pit copper mines continued, and progress was made in devising mathematical and statistical techniques to indicate probability and cost of mineral discovery. Procedures were devised to determine rock permeability and to aid in a



Bureau mining studies are emphasizing development of new techniques and equipment like the electrohydraulic diamond drill shown here.

predevelopment estimation of mine-water-control problems. Explosive anchorage of rock bolts for underground support in softer rocks showed promise. A new series of tests was begun with Bureau-developed precast concrete support sets of improved design. Investigations of hydraulic transportation of solids for mine-stope fill material were completed, in preparation for research to determine the effectiveness of fill material in ground support. Bureau mining engineers cooperated with industry to develop devices for determining stress deformation in rocks and concrete linings around slusher and haulage drifts in mines using block-caving methods.

Progress also was made in rock physics, chiefly in isolating causes of the high pressures and stresses that cause severe ground-control problems in deep mines. Work was underway to develop methods of interpreting these stresses so that mines can be designed scientifically to provide for better and safer ground support and improved rock-burst control.

Blasting phenomena recorded during field tests with a new mobile laboratory yielded information on the effect of "coupling" and the correlation of strain propagation laws for conventional blasting with low-yield nuclear explosives.

Design specifications for constructing a borehole deformation gage to determine stress in mine rock were published by the Bureau during the year. Widely circulated throughout the mining industry, this was the first publication of its type to have practical application in stress analysis of mine structures.

Titanium Technology Aided

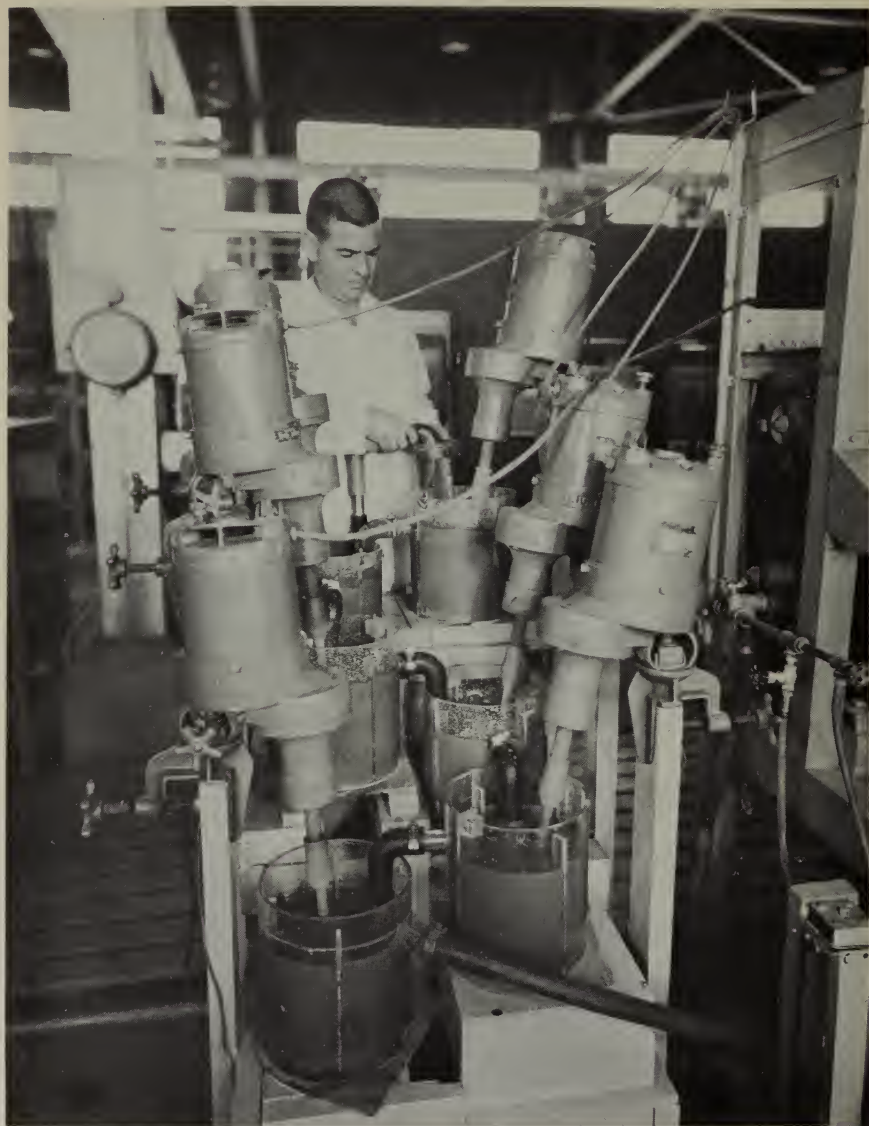
Electrowinning of titanium metal was advanced in 1962. Bureau metallurgists, developing a theory on the reaction between titanium metal and titanium chlorides in fused salts, devised an improved salt bath, which makes it possible for titanium metal to be deposited from a liquid anode. They also learned that certain titanium alloys can be deposited electrolytically. These and other studies on fundamental principles of electrolysis led to a better understanding of electrochemical reactions in fused salts.

An apparatus devised by the Bureau established that magnesium can be induction-melted and heated under pressure to temperatures above its boiling point without excessive loss by vaporization. Studies continued on ways to relate the composition and structure of dilute magnesium alloys to their strength and damping capacity.

Operation of the Bureau's experimental pilot plant at Kings Mountain, N.C., terminated after it had fulfilled its purpose by proving the practicality of the Bureau-devised flotation method for concentrating beryl from the tailings of a spodumene mill. A patent was issued for a process of separating spodumene and beryl by flotation, developed by the Bureau in an earlier study of the same pegmatite tailings. Phenacite- and bertrandite-bearing beryllium ores from Nevada were upgraded by flotation. Studies of bertrandite-bearing tuff from Utah indicated that it cannot be beneficiated but that bulk-leaching methods may extract beryllium. Research continued on ways to produce extremely pure beryllium by electrorefining. High-purity beryllium chloride was produced as a starting material for electrolytic reduction to high-purity metal.

Search for Domestic Sources of Alumina Continued

Experiments continued on recovering alumina from low-grade bauxites and other aluminous materials. Extensive process evaluations were made of three techniques to recover alumina from what are now noncommercial sources. Research progressed on a lime-soda-sinter process, and a new project was begun to determine chemical requirements for a melt-quench-leach process. A Bureau modification of the Bayer process was used in experimental processing of samples of iron-bearing bauxite material from Hawaii.



Beryllium ore, ground to a pulp, is "conditioned" in this multistage unit at a Bureau of Mines laboratory before being processed further to separate the valuable minerals from the waste material.

The Bureau devised a new method for separating hafnium from zirconium. Hafnium-containing zircon is fused with potassium silicofluoride to form soluble hafnium and zirconium compounds.

Metallurgical research on the rare earths included studies of their basic properties, as well as methods of separation, analysis, metal

reduction, and refining. Large homogeneous cerium ingots were produced from metal tapped from a continuously operated electro-winning cell. The purest cerium metal ever assayed was produced by the Bureau during the year.

A modified solvent-extraction technique promised effective separation of yttrium from heavy rare-earth elements, and a new cell design reduced contamination of electrowon yttrium by carbon and oxygen. Improved recovery of yttrium and thorium from western thorite ores was achieved by solvent extraction, and a potential source of scandium was found in impure phosphoric acid at phosphate-rock processing plants.

Radioactive Pollution Minimized

The Bureau developed new techniques for beneficiating low-grade uranium ores and for minimizing radioactive pollution of surface waters from uranium mill wastes.

The reduction-segregation copper process—developed by Bureau scientists and first applied commercially to refractory oxidized copper ores in Arizona—proved applicable in pilot-scale tests on mixed oxide-sulfide copper ore from Mauritania, Africa. Other reports described techniques for gaseous reduction of blister copper and improved smelting of copper precipitation dusts. A froth-flotation concentration method for removing mica, feldspars, and other minerals from pollucite, leaving a product containing 20 to 30 percent cesium, was reported.

Studies were made on separating and purifying nonferrous metals by such techniques as using inert-gas carriers of volatile metals, adding flux to remove an impurity selectively, and adding another metal to combine with or modify the reaction of a metallic impurity during vacuum distillation.

As a first step toward improving zinc-base alloys by adding rare-earth metals, a new means of measuring molten-metal fluidity was devised.

Novel Attack on Air Pollution

In a major step to recover a useful product from noxious gases formerly discharged to the atmosphere, the Bureau developed a process to produce hydrofluoric acid from waste fluosilicic acid. More than nine-tenths of the fluorine in certain waste gases was recovered as relatively pure hydrofluoric acid with the new process.

Research continued on preparing pure metallic boron for high-temperature and electronic applications. Consolidated, polycrystalline, high-purity boron was prepared by melting amorphous boron

in an electron-beam furnace. Experiments in remelting boron and in growing boron crystals were conducted in an arc-image furnace.

Synthetic-mica research furnished data on properties of germanium-containing mica, how to promote growth of large crystals, and how to prepare machinable dielectrics by devitrifying mica glasses. Efforts by the Bureau to improve the properties of its reconstituted mica paper included making the paper from new experimental melts of water-swelling micas and forming the film from which the paper is made with various flocculating agents. Cooperative research developed a mica flotation process which the cooperating firm adopted to increase recovery of mica at its plant near Heflin, Ala.

Basic studies continued during the year on the properties of high-temperature refractory oxides of zirconium, hafnium, and several rare-earth elements, using equipment and methods specially developed by the Bureau for the purpose. Research was begun on mixed borides and boride-oxide systems which hold promise as high-temperature refractories. Data from these studies may make it possible to design high-temperature refractories with special properties required for specific applications, without using costly and time-consuming trial-and-error methods.

Ceramics Rolled to Shape

Bureau engineers conducted research on roll forming various ceramic materials to close dimensional tolerances. Specially designed equipment maintained rolling temperatures as high as 1,500° C. Thickness of aluminum-feldspar billets was reduced as much as 75 percent. New equipment designed and constructed during the year will permit roll forming at temperatures as high as 1,900° C, greatly extending the usefulness of this method.

Many large deposits of fire clay in Missouri and Ohio which contain excessive quartz, pyrite, and other impurities can now be upgraded to meet high-heat-duty and superduty refractory requirements as the result of research conducted by the Bureau. Studies on kaolin beneficiation yielded improvements in continuous, closed-circuit grinding; producers of paper-coating clay conducted similar research using Bureau-developed equipment and processes. Sampling and evaluation of clays and shales for potential use as raw materials in producing lightweight aggregate continued in the Midwestern, Southeastern, and Northeastern States to meet the rapidly expanding demand for this important construction material. The work was performed in cooperation with other Federal agencies, State agencies, and industrial concerns.

Observations were made at quarries in Iowa and Ohio to help determine the laws governing propagation of ground vibrations resulting from quarry blasting.

Mineral-Resource Activities

Bureau of Mines engineers and mineral economists carried forward examinations of mineral deposits, studies of mineral-economics problems, and investigations of mining and milling methods and costs in almost every State. At least 50 reports of these studies were issued or in process at the end of the fiscal year, in addition to the separate State chapters making up volume 3 of the Bureau's Minerals Yearbook. Technical advice and assistance were furnished to other Federal and State agencies, local area redevelopment groups, and the general public.

Many Resource Surveys Conducted

Examinations and surveys of mineral resources, many conducted in cooperation with State agencies, covered a wide range of commodities and localities.



A Bureau of Mines geologist uses a portable detector to check drill-hole cuttings during a nationwide search for strategic beryllium.

Areas of potential beryllium mineralization were examined in Arizona, California, Colorado, Idaho, Nevada, Texas, and the New England States. In Idaho, the investigations provided information on 30 beryllium occurrences, two-thirds of which were previously unknown. The known area of low-grade beryllium mineralization in Idaho's Sawtooth Mountains was extended by drilling and sampling to more than 40 square miles.

Bureau investigations in the Beluga coalfield, Alaska, were completed during the year. Core drilling indicated subbituminous coal reserves in excess of 20 million tons in a seam over 50 feet thick and apparently suitable for opencut mining. The State of Alaska took title to the Beluga area from the Federal Government as part of the statehood grant lands and already has issued several coal-prospecting permits to private companies.

Several other significant mineral-economics projects completed during the year included an analysis and projection of the future of Alaska's mineral industry, a similar report on the aluminum industry of the Pacific Northwest, and a report on the petroleum resources of West Virginia. An important new project begun in fiscal 1962 was a study of the mineral-resource base of the Pacific Northwest for the Department's Bonneville Power Administration. It will include estimates of future employment and electric-power requirements for mineral production as basic data for determining the long-range electric-power needs of the region.

A survey of mineral raw materials used by producers of chemicals and allied products in California and Nevada was nearly completed. Facilitated by excellent industry cooperation, this study is expected to make available for the first time significant data on requirements and sources of supply for minerals used in the chemical industries.

Water Resources and Uses Studied

Bureau engineers completed a comprehensive study of water in relation to Arizona's mineral industries, covering such aspects as supply, adequacy, cost, treatment, uses, and disposal. The experience gained is expected to prove useful in conducting similar investigations and in forecasting requirements for other parts of the Nation. In progress at yearend was a survey of water requirements and uses in petroleum producing and refining industries of the Southwest.

Among several reports covering significant mining and milling methods and costs was one describing the role of automatic data processing (ADP) in managing a Michigan copper mine. The Bureau increased its own use of ADP in its statistical work and was considering applying ADP to data retrieval problems.

Economic Variables of Mineral Industries

During the year, the Bureau continued and expanded its studies of the basic economic variables most significant for the mineral industries. Reports were published on cyclical variations in the copper, lead, and zinc industries; on the demand for salt; and on the source and disposition of energy in the United States. The salt and energy studies illustrated methodologies and techniques which can be applied or adapted elsewhere to advantage.

As the year ended, the Bureau was developing a study of the materials and supply requirements of the mining industries for use in a Government-wide investigation of interindustry flows of commodities.

River-Basin Activities

Bureau of Mines participation in river-basin activities expanded substantially in fiscal 1962. Requests from other Federal agencies for review of projects for flood control, harbor improvement, electric-power generation, soil conservation, water supply, and other purposes increased from 158 in 1961 to 248 in 1962. These were exclusive of many informal field-level reviews and extensive office and field investigations. The Bureau also assisted and guided other State and Federal agencies engaged in preauthorization negotiations and preconstruction planning. It completed 20 mineral reconnaissance surveys for the Department's Bureau of Reclamation and the U.S. Army Corps of Engineers. Of 30 other similar surveys conducted on proposed reservoir sites for the U.S. Study Commission—Texas, 13 called attention to major mineral problems that require resolution either before authorization or during preconstruction planning.

Such river-basin studies protect the national interest in several ways, indicating what minerals must be mined before inundation, what minerals can be recovered after inundation, and what other minerals can be removed after inundation if suitable provisions are made in advance.

Rampart Reservoir in Alaska Studied

In Alaska, the Bureau worked closely with the Corps of Engineers to delineate and evaluate mineral resources in the 11,000-square-mile Rampart Reservoir site and to determine the economic effect of a proposed 5-million-kilowatt power development on the mineral resources and industry of the State. Bureau staff participated in meetings of the Rampart Economic Advisory Board and contributed to plans for additional mineral-resource studies.

Missouri Basin Studies Continued

Reconnaissance examination of 13 proposed reservoir sites in the Missouri River basin were made to determine how construction of dams would affect mineral resources and mineral industries in the immediate areas. Analyses of benefits and damages at each of the sites were submitted to the construction agency concerned, and in several instances, conservation methods were suggested to safeguard major mineral deposits. A reconnaissance of the Fort Peck-Fort Benton reach of the Missouri Basin in Montana was reported to the Secretary of the Interior.

Mineral-resource and industry-feasibility studies on the Turtle Mountain and Fort Berthold Indian Reservations in North Dakota and on the Blackfeet Reservation in Montana were completed. Similar studies began on four other reservations in the Dakotas, Montana, and Wyoming. These studies will aid in preparing overall economic development plans for the Area Redevelopment Administration and in planning for the economic development of the reservations. Studies on the mineral resources of the Milk River basin in Montana and its mineral-industry water needs and supplies were in progress as the year ended.

Manuscripts on the oil and gas resources of the Yellowstone Basin in Montana and on the fusibility characteristics of lignite ash were completed. The report on waterborne mineral wastes and industrial water uses in Kansas and Missouri was published and distributed. Further field research on techniques and materials for lining canals confirmed the effectiveness of sodium carbonate in reducing seepage and preventing erosion when the material is sprayed directly on simulated damp canal banks.

Air-Pollution Control

The Bureau of Mines—cooperating with the Public Health Service of the Department of Health, Education, and Welfare—intensified its already active participation in Federal air-pollution-control programs. At research centers in Pittsburgh, Pa., Bartlesville, Okla., and Laramie, Wyo., the Bureau sought to pinpoint sources of pollution as mineral fuels were burned for heat and power and sought to evolve methods of altering or improving combustion to reduce pollution. The Bureau continued to represent the Department of the Interior on the Interdepartmental Committee on Community Air Pollution as well as on the Air Resources Subcommittee of the Natural Resources Committee, Federal Council for Science and Technology.

Giving special emphasis to studies of air pollution caused by automotive exhausts, the Bureau developed new information on catalytic and flame-afterburner treatment for noxious components of gasoline-engine exhausts, and on the organic compounds present in the exhausts of diesel engines. Methods were devised for sampling and analyzing products from a special test chamber in which engine exhaust gases undergo reactions simulating those that take place under usual outdoor conditions.



Scientists and engineers at this Bureau of Mines pilot plant are fighting an important battle in the war against pollution. They are developing an improved method for removing the pollutant, sulfur dioxide, from industrial flue gases.

Gas-chromatograph analytical procedures, developed originally for studies of gasoline-engine exhaust gases, were adopted for use on products of diesel combustion. Although they cannot yet be used to separate and identify all significant exhaust components, the methods constitute a marked advance in analytical capability. Bureau scientists demonstrated the feasibility of a method they recently developed for removing sulfur dioxide from flue gases, and also provided new information on concentrations of oxides of nitrogen and sulfur in boilers of coal-burning furnaces. As part of a national survey of fires in coal-mine refuse piles, these fires were cataloged by general location, size of pile, and stage of burning.

Bituminous Coal Activities

Bureau research continued to stress improved methods of mining, preparing, processing, and using bituminous coal and lignite.

Experiments in which a high-pressure water jet was used to extract coal from the Pittsburgh bed in western Pennsylvania indicated that productivity rates depend on the velocity and volume of the water jet and the speed with which it traverses the coal face. The hydraulic method also was tested in mining pillars in a pitching coalbed near Roslyn, Wash., and productivity during the experiment was 50 percent higher than that achieved by conventional methods under the same conditions.

Combustible methane was removed in advance of mining by two methods applied by the Bureau in a series of experiments conducted in a cooperating mine in the Pocahontas No. 4 coalbed in West Virginia. In one method, methane escapes from the coal through holes drilled horizontally into the seam. In the other, water is injected into the coal seam to force the gas out. These experiments not only produced much safer atmospheres but indicated that costly shutdowns, normally required for removal of gas by conventional ventilation during mining, can probably be avoided.

Hydraulic transportation of larger sized coal was investigated to determine the feasibility of combining hydraulic mining processes with coal pipelines. Over 40 percent by weight of coal up to 2 inches in diameter was moved successfully in water in a 6-inch-diameter test pipe 1,350 feet long.

A comprehensive study of concentrating tables for cleaning coal indicated that their performance can be predicted more accurately than was previously realized.

Utah Coal Studied for Use in California

In cooperative research, the Bureau found that a virtually unused low-grade coal from southern Utah can be upgraded for use in cement manufacturing in California and that more of California's increasing energy requirements may later be supplied by coal from the Rocky Mountain area.

Further progress was made in developing a coal-fired gas turbine for central-station powerplants. Operated in conjunction with a standard steam boiler, such a coal-fired turbine promises a 4- to 8-percent increase in overall efficiency. Used as a separate unit, the turbine—requiring no water—could prove an ideal power generator in water-scarce areas.

A new pilot plant reactor for continuous entrained-state carbonization of coking coals permits operation at high capacities and temperatures and facilitates study of optimum reactor length.

Investigations were made of the effect of rank of coal, fuel-bed thickness, grate speed, and airflow rate on the yield and quality of cokes produced for use in chemical processes in chain-grate stokers, a type of equipment now attracting considerable industrial interest.

Radiant heat-transfer studies showed how ash and slag deposits are important in determining heat distribution in large steam-boiler furnaces.

A method was developed for feeding pulverized coal in steam to an oxygen-blown gasifier operating at pressures of 150 to 300 pounds per square inch. In research aimed at obtaining gas from eastern coking coals, these coals were heated systematically in steam and air to reduce their coking properties.

Lignite Uses Studied

Extensive experimentation in ways of using lignite and subbituminous coals continued. This included using artificially oxidized lignite and leonardite (naturally oxidized lignite) for soil conditioning and for fertilizing, and further work in developing the Bureau's fixed-bed slagging lignite gasifier.

Cooperative experiments conducted with funds supplied by the Atomic Energy Commission examined the effects of gamma radiation on the reaction of coal with steam. The Commission continued to support research on using a simulated reactor to provide a high-temperature heat for coal processing.

Low-cost, active catalysts for synthesizing methane from carbon monoxide and hydrogen were prepared by flame spraying thin layers of metals and metal oxides on plate or tube surfaces inside a reactor.

Process development continued on converting bituminous coal to high-B.t.u. gas. Experiments demonstrated that such gas can be produced directly by hydrogenation of coal with a low hydrogen-to-coal ratio, making the removal of excess hydrogen unnecessary. Promising results indicated that gaseous products from the reaction of coal and steam at high pressure, including the bulk of normally unreactive carbon dioxide, can be upgraded to high-B.t.u. gas by passing them over a tungsten sulfide catalyst without intermediate removal of sulfur.

Removal of sulfur from high-temperature coke with coke-oven gas may be a means for producing metallurgical coke from coals presently unsuitable because of excessive sulfur.

Catalytic hydrogenation of coal to yield large quantities of hydrogen was achieved for the first time. More than half the hydrogen in a typical Pittsburgh-seam coal was liberated by heating the coal in a nitrogen-containing solvent in the presence of a palladium catalyst.

Microbiological studies were extended to include the lower ranks of coal. Up to 80 percent of the pyritic sulfur in some of these coals was removed by bacterial action. Using other bacteria to remove methane from coal mines was being investigated at yearend.



In research on obtaining new or improved products from one of the Nation's most abundant resources, Bureau scientists are reacting coal at extremely high temperatures in this "plasma jet" unit . . .



. . . and at high pressures in the experimental apparatus shown here.

Other studies included irradiating coal in an atomic pile at high levels of neutron and gamma flux, reacting coal in a plasma jet at extreme temperatures—up to $30,000^{\circ}\text{C}$, hydrogenating oil from coal to make fuels for supersonic jet aircraft, producing carbon disulfide from coal, and upgrading low-temperature tar to commercially valuable products.

Bituminous Coal Economics Analyzed

The downward trend in bituminous coal and lignite production was reversed in fiscal 1962. Much of the gain resulted from steadily increased consumption of coal by electric-power utilities, and this trend is expected to continue. Special economic studies were made of the distribution and consumption of coal as related to the competitive energy market. Other special analyses by the Bureau of Mines spotted significant trends developing in worldwide energy supplies and utilization. Comprehensive reports were made to other Federal agencies on both domestic and foreign developments related to the role of coal, coke, and coal chemicals in mobilization planning.



A high-speed framing camera, developed by the Bureau, is used to obtain new knowledge about explosives and explosions. The seven frames shown at the extreme right are part of sequence recording an event that took place in 0.00008 second.

Explosives and Explosions Studied

The Bureau completed a new high-speed photographic installation for studying explosions and detonations. Its equipment includes a new high-speed framing camera (top speed, 25 frames in 0.00002 second) and a streak camera for making displacement-versus-time records (maximum image sweep rate, 5,000 meters per second). The same event can be recorded simultaneously with both cameras. A two-channel submicrosecond (one-ten-millionth-of-a-second exposure) flash

X-ray system—also acquired during the year—was used to study high-speed events in opaque materials, such as shock and detonation waves in solid explosives and hypervelocity impact on metals.

Self-sealing plastic bags filled with water were approved by the Bureau as permissible for stemming borehole shots in coal. Other research on permissible explosives and blasting agents is providing information that will be helpful in promoting safer use of these materials.

Further cooperative study—with the Manufacturing Chemists Association—on the fire and explosion hazards of ammonium nitrate in pure form and with various contaminants yielded valuable information on its safety characteristics. Studies on the explosion hazards of liquid hydrogen were extended to problems associated with its use in high-energy nuclear-physics laboratories.

Several accidents involving fires and explosions were investigated. Potential hazards involving a number of flammable materials were studied and the results were published.

Major noise and blast effects were eliminated by constructing a new closed gallery for testing explosives at Bruceton, Pa. Good results in curtailing noise also were obtained by enclosing a number of bomb-proof structures used in explosives research.

Anthracite

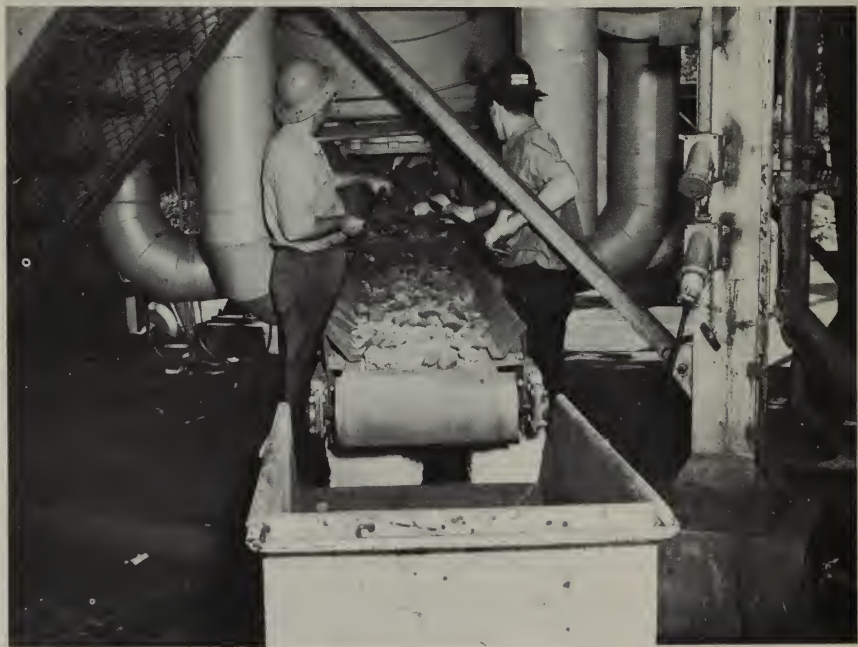
During the year, the Bureau continued to develop improved methods for mining and transporting anthracite and preparing it for market and further investigated its metallurgical and fuel potential, particularly in blast furnaces. Fundamental chemical, electrical, and physical properties were studied. The Bureau's administrative, engineering and inspectional services again implemented jointly financed Federal and Commonwealth of Pennsylvania programs for controlling mine waters and inactive coal-mine fires in the anthracite region.

Underground demonstrations of the Bureau's prototype hydraulic anthracite-mining system aroused great interest. Regular operation of this system in a cooperating mine at Sugar Notch, south of Wilkes-Barre, Pa., proved its technical feasibility and superior safety. By eliminating blasting the system avoids such hazards as airborne coal dust and dislodged roof supports, as well as the danger of storing, handling, and firing explosives underground. To handle up to 5,000 pounds of pressure at the water-jet nozzle—higher than the pressure required for "soft" coal—the anthracite monitor is mounted on a self-propelled chassis called a jumbo.

Extensive surface tests of the Bureau's experimental hydraulic hoisting apparatus proved its mechanical effectiveness. At yearend, negotiations were underway to place the equipment in an operating underground mine for final on-the-job testing before it is considered for integration with the hydraulic anthracite-mining system.

A large quantity of anthracite briquets—formulated, manufactured, and calcined at the Bureau of Mines Anthracite Research Center, Schuylkill Haven, Pa.—performed favorably in the Bureau's experimental blast furnace at Bruceton in a series of runs concluded in May 1962. Evaluation of the data commenced in preparation for Bureau of Mines publication. Under a cooperative agreement with a major steel producer, other tests to develop pressure-drop data for blast furnaces were continued in the simulated stock column at Schuylkill Haven.

Two mine-water control projects were completed. One costing about \$80,000 provided surface improvements at the Wanamie mine. The other was a \$190,000 deep-well pump installation at the South Wilkes-Barre shaft. The Bureau's study of the effect of vast underground mine workings on the stability of surface improvements in the



These anthracite briquets, made at a Bureau of Mines research center, have just been tested to determine how they will perform in a blast furnace. This phase of the Bureau's program is directed toward opening a new market for anthracite as a metallurgical fuel.

Susquehanna River basin of the northern anthracite fields was about 25 percent completed, and an interim report was submitted to the U.S. Army Corps of Engineers.

Auger-Type Borer Ordered

A contract was awarded for constructing a large-diameter auger-type boring machine designed to Bureau specifications for work in pitching anthracite seams. When delivered, the machine is to be used in a cooperating mine where it is expected to reduce underground mining costs by improving productivity rates.

Survey schedules for collecting anthracite production and distribution data were revised during the year, and increased response and coverage were achieved.

Health and Safety Activities

Safe and efficient mine operations remained the principal objective of Bureau health and safety programs during the fiscal year as progress was made in mine-roof control, development of a practical methane-monitoring system for gassy mechanized coal mines was advanced, and several new types of mining equipment received the Bureau's seal of permissibility.

Highlighting the year were experiments and field tests that demonstrated the versatility of rigid polyurethane foam in sealing and maintaining the stability of mine openings, controlling ventilation, combating mine fires, and insulating combustible material from heat. Made by combining two readily available chemicals that expand in seconds to many times their volume, this foam, which becomes rigid in a few minutes, promises to be useful in many phases of mining.

Early in 1962, the Bureau was designated by the Secretary of the Interior to conduct field and other investigations needed to carry out Public Law 87-300, which authorized a study of health and safety conditions in metal and nonmetal mines (except coal and lignite). A three-member Mine Safety Study Board was appointed by the Secretary to help guide the work. The information obtained will be reported by the Secretary to the Congress, with his evaluation of present conditions in this sector of the mining industry.

Roof Hazards Studied

Research on ways to prevent unexpected roof falls continued as the Bureau sought to provide more scientific methods of control. A compact, portable sonar device, designed in 1961 to detect hidden

roof weaknesses, demonstrated its sensitivity and reliability in extended laboratory tests.

Causes of coal bursts or "bumps" also were investigated. Special hydraulic load cells, developed by the Bureau, were used to measure internal stresses in coal-mine pillars and adjacent rock strata at a West Virginia coal mine susceptible to "bumps." Preliminary results were encouraging.

Investigation of pressures caused by water or gas in coal-mine roof indicated that such pressures contribute to roof failures. Additional tests to determine how these pressures are generated and to devise means for their control were underway at the end of the year.

Continuing research was directed toward improving roof-bolting equipment and accessories and toward providing basic information on effective functioning of bolt assemblies. These studies involved measuring rock hardness with a "penetrometer," to find quickly the best anchorage "horizon" for roof bolts; modifying the size and adaptability of roof-bolt anchorage test equipment; standardizing tests of bearing plates and other roof-bolting materials; and developing a simple roof-bolt-tension indicator to obtain greater uniformity in bolt installations.



Bureau of Mines engineers test a device newly developed by the Bureau for determining whether roof bolts are securely anchored in the layers of earth and rock they are designed to support.

Related laboratory research continued on strengthening mine roof by injecting bonding agents made of polyester resins into roof cavities and planes of weakness. Field tests at intersections of coal-mine entries indicate that such bonding reinforces roof bolting. Tests in a metal mine also showed safer, more economical consolidation of fractured metamorphic rocks when bonding agents were used to supplement roof bolts.

Mine Ventilation Analyzed

Ventilation surveys were conducted in two coal and two noncoal mines. The Bureau's fluid network analyzer was used to advantage in planning effective ventilating systems. Healthful working atmosphere also is the objective of a cooperative study, begun during the year, of mine air conditioning at a Montana copper mine. The knowledge gained will be increasingly valuable as mining extends to greater depths.

Tests in the Bureau's experimental mine at Bruceton, Pa., demonstrated that water, when properly mixed with coal dust, neutralizes the explosion hazard of the dust. However, it was found that water



Using a small blower device, a Bureau of Mines scientist dispenses a cloud of cellulose acetate dust over a lighted candle, demonstrating one of the hazards encountered in handling combustible industrial materials.

naturally present in a mine ordinarily cannot be depended upon to achieve this effect.

Effects of particle size and shape and of concentration on ignition sensitivity and explosion severity of many combustible dusts were determined during the year.

Methane-Monitoring Research Progressed

Three prototype methane-monitoring detectors were tested extensively in the experimental mine to determine performance and stability under conditions of temperature, humidity, and airflow normally found in mines. Results for two of the units were so promising that they will be further tested in an active coal mine.

Fundamental research on controlled combustion of methane yielded information that will be helpful in improving methane detecting and monitoring devices. In another approach to the same objective, the Bureau began development of simplified transistorized circuits for methane monitors.

New Equipment Approved

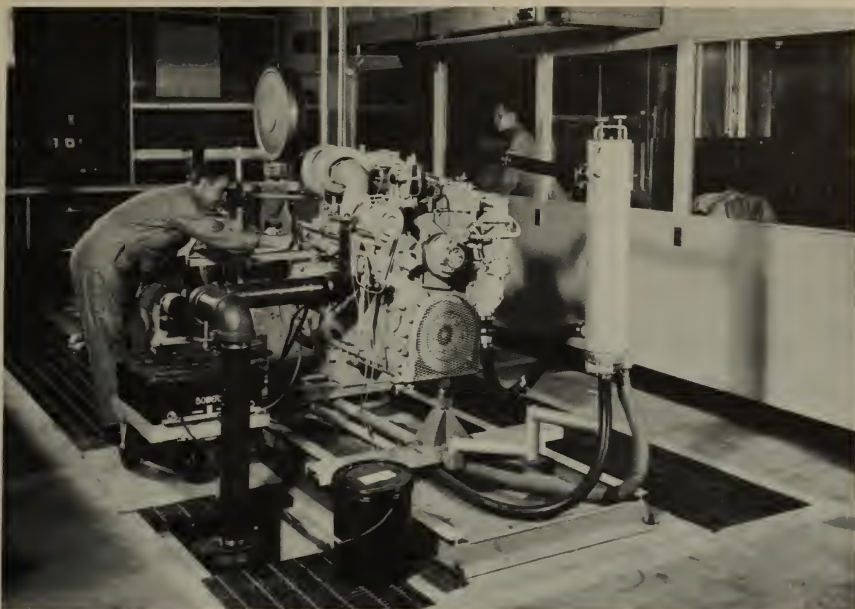
Demand continued for the Bureau's technical services and testing facilities to determine permissibility of electric- and diesel-powered mining equipment and related devices required by modifications and improvements in mine mechanization.

The first diesel-powered machine—a shuttle car—was approved for use in gassy noncoal mines and tunnels. Subsequently, additional approvals were issued for six diesel-powered locomotives, three tractors, and two shuttle cars. Five diesel-engine subassemblies with exhaust-gas conditioners were certified for use on approved diesel machines in noncoal mines.

Bureau approvals also were issued during the year for the following kinds of electric-powered equipment: 10 continuous miners, 3 conventional mining machines, 9 shuttle cars, 9 loading machines, 10 conveyors, 7 face drills, 3 distribution boxes, 1 splice box, 1 roof-bolting machine, 9 utility trucks, 2 rock dusters, 2 drill-boom carriers, 2 coal crushers, 2 air compressors, 1 drill dozer, 1 hydraulic pump unit, 2 communication devices, and 1 dust-particle counter.

In all, there were 265 formal approvals and 722 informal extensions of approval for electrical-mechanical equipment. Fifty-nine compartments were explosion-tested, and 2,052 tests were made in explosive natural gas-air mixtures. Flame tests were given 15 conveyor belts and 24 electric cables, including the first Hypalon-covered cable.

Eleven approvals and 20 extensions of approval were issued for coal-mine roof drills with integral dust-collecting systems. Twelve



Mining equipment is tested rigorously before it is approved for use underground. Here, a Bureau technician samples exhaust gases generated by a diesel engine that has been submitted by the manufacturer for testing.

approvals and 123 extensions of approval were granted various respiratory-protective devices.

Three approvals, covering 5 fire-resistant hydraulic fluids, and 1 extension of approval, covering 2 fluids, brought to 15 the total of approvals covering 30 fire-resistant hydraulic fluids issued since the Bureau began testing these materials.

New Health Studies Launched

Dust generated by continuous-mining machines in coal mines is the subject of a new Bureau project aimed at developing methods for alleviating this problem. A newly developed "referee" dust slide for use in teaching dust-counting techniques will be useful for comparing dust counts by different laboratories and in developing new counting procedures.

Portable, commercial, tube-type detectors were evaluated—under controlled laboratory conditions—for effectiveness in detecting toxic mine gases, carbon monoxide and nitrogen oxides in engine exhausts, and piston blowby gases from diesel engines. Chemical effects of nitrogen oxides in low concentrations in air also were studied. Other tests were made to determine the nature and quantity of toxic gases

produced when rigid polyurethane foam is subjected to heating and combustion reactions.

Procedures were developed for testing dispersoid respirators designed to protect against highly toxic particles in air. Nearly 200 samples of airborne dust, minerals, and dust-source materials were analyzed by X-ray diffraction and emission spectrography. Approximately 20,000 atmospheric samples from coal-mine inspections and other sources were analyzed in the Bureau's three gas-analysis laboratories.

Silicosis and Radiation Hazards Studied

Joint studies by the Bureau of Mines and the Public Health Service to evaluate the silicosis problem in metal mining, begun in April 1958, were completed during the year. The Bureau appraised the environmental aspects, and the Public Health Service the medical aspects of the problem. Sixty-seven representative underground metal mines were investigated, and 14,000 workers were examined. A report is now in preparation.

Investigations in uranium mines were continued, making use of a new method to evaluate health and safety hazards, particularly the full-shift, weighted-average exposure of workers to alpha-emitting decay products of radon. At the request of State authorities, the Bureau inspected health and safety conditions in 54 uranium mines in Utah. It continued to cooperate with the Public Health Service, Atomic Energy Commission, and Federal Radiation Council on worker exposure to radiation in uranium mining.

Safety Education Extended

More than 5,300 mineral-industry workmen and officials completed training in the Bureau's various accident-prevention courses during the year. Emphasis on training mine supervisors in fundamentals of accident prevention continued as enrollment in these courses increased 25 percent over the previous fiscal year. Twenty-nine thousand workers completed first-aid and mine rescue training. Efforts to obtain 100-percent employee participation in first-aid classes were increasingly successful.

Two new motion pictures, as well as slides, posters, and other visual aids to safety education, were produced. One film dealt with the training of mine personnel in rescue and recovery work after mine disasters; the other reported Bureau research on hydraulic mining of anthracite, emphasizing safety. Films in the Bureau's safety series were viewed by 120,000 mineral-industry workers, and lecture-demonstrations of fire, explosion, and mine-gas hazards were attended by more than 68,000.

Safety Contest Sponsorship Broadened

During the year the Bureau assumed full responsibility for the National Safety Competition, formerly cosponsored for 36 years by the Explosives Engineer magazine, which ceased publication in December 1961. More than 1,500 mines, quarries, and other mineral-industry operations competed in the National Safety Competition and other nationwide contests conducted by the Bureau in fiscal 1962, and more than 3,000 employees of winning companies were awarded certificates of accomplishment in safety. Contests covering operations in sand and gravel, slag, crushed stone, and lime were again cosponsored by active associations within those four industries. The first annual nationwide contest among oil-well drillers was carried to a successful conclusion, and arrangements were completed for the first contest to be sponsored by the National Limestone Institute.

The Bureau continued to report on injuries and employment in mineral industries. Information on fatal and nonfatal injuries and related data, gathered from operators of coal mines under authority of the Federal Coal Mine Safety Act, was issued monthly and annually. Statistics for metal, nonmetal, quarry, sand and gravel, coke, peat, iron blast-furnace slag, and petroleum and natural gas industries were published annually.

Fires in Inactive Coal Deposits Controlled

During the year, 14 fire-control projects were completed—7 in the public domain, 3 on Indian land, and 4 on private property. At yearend, projects were underway to control or extinguish seven other fires.

Some 107 fires in inactive coal deposits have been extinguished or controlled with Bureau guidance since 1949, when funds were first appropriated for this purpose. Of these, 59 were in the public domain, on Indian lands, or on other properties where federally owned coal was threatened; and 48 were on private property, mostly in residential areas.

Bureau records showed 223 other uncontrolled fires were burning in inactive coal deposits at the close of this year. Of these, 105 had been investigated and their control will be undertaken as appropriated funds permit and as matching funds are available, where required. Work was performed on completed projects as necessary to keep fires from rekindling.

10th Anniversary of Federal Coal Mine Safety Act Noted

Fiscal 1962 marked completion of the first full decade of inspection authorized by the Federal Coal Mine Safety Act. Title I of the act

authorizes inspection of coal mines and reporting of hazards, including recommendations for their correction. Title II of the act provides specific enforcement powers to prevent major disasters from explosions, fires, inundations, and man-trip and man-hoist accidents in mines regularly employing 15 or more men underground.

Of the 9,993 coal mines active during the year, 1,045 were classed as title II mines. The rest, including 7,256 small underground mines, 1,413 strip mines, and 279 auger mines, were classified under title I.

During the year, 2,610 routine inspections of title II mines were completed. Special followup inspections also were made to determine whether previously cited violations had been corrected.

Orders requiring withdrawal of men from all or part of 64 mines totaled 117; 81 of these were at 49 mines because of imminent danger, and 36 orders were at 15 mines for failure to abate violations in a reasonable time. Orders were issued classing as gassy nine mines previously considered nongassy.

Federal inspectors and engineers also made 10,450 routine visits to title I mines (including 1,112 strip- and 232 auger-mine inspections) and conducted many roof-control, electrical, ventilation, dust, blasting, and related surveys, as well as investigations of fatal and serious accidents, mine fires, gas and dust ignitions, and miscellaneous conditions.

Preliminary reports for calendar year 1961 showed 292 coal-mine fatalities, compared with 325 in 1960. The fatality-frequency rate per million man-hours of exposure was 1.20 in 1961, compared with 1.15 the previous year. The fatality-frequency rate for the first 5 months of 1962 was 0.77.

A single major disaster occurred during the year, claiming the lives of 11 workers in an Illinois coal mine.

A nationwide survey of thermal-drying units is underway in bituminous coal preparation plants to prevent potential major catastrophes. Changes in design and operation, and additional safeguards, will be recommended to eliminate numerous dust ignitions that have occurred in these units. Thus far, all have been small.

Foreign Activities

Bureau facilities for gathering and analyzing statistical and economical information on foreign minerals were used extensively by other Federal agencies, and U.S. industries and investors, during the year. More than 6,000 specific public and Government inquiries were answered. World production and international trade statistics comprised an important segment of the Bureau's Minerals Yearbook,

and numerous other continuing services were performed in maintaining the Government's mineral-information program.

In response to Congressional request for special studies in connection with a review of U.S. foreign trade policies, the Bureau analyzed production, trade, and mineral self-sufficiency of three groups of countries—the Sino-Soviet Bloc, the industrial West (including Japan), and the rest of the world.



A Bureau engineer instructs Mexican miners in mine-rescue procedures.

Commodity Imbalance Data Assembled

Fundamental data were assembled by the Bureau on such international commodity problems as imbalances in world supply and demand for lead and zinc which have concerned Government and trade agencies for several years. World shortages of tin, disposal of surplus minerals from U.S. stockpiles, and the effect of expanding Soviet oil exports on U.S. and free-world petroleum economics also received attention.

During fiscal 1962, foreign aid field projects were served by 18 Bureau technologists in 10 countries: Afghanistan, El Salvador, Indonesia, Mexico, Nepal, Pakistan, Peru, South Korea, Taiwan, and Turkey. Bureau laboratory and staff facilities in the United States also contributed to these projects.

An important part of foreign aid is training foreign technicians in the United States. During the year, the Bureau assisted 69 foreign trainees. At yearend, 36 were still in training under Bureau auspices. Countries represented included Afghanistan, Egypt, Indonesia, the Malagasy Republic, Mexico, Nepal, the Philippines, South Korea, Taiwan, Thailand, and Yugoslavia.

Exchange of scientific, technical, and economic information was fostered when several Bureau experts attended and presented papers at various international meetings. Bureau specialists also participated in discussions of mineral education in Latin America preliminary to formulating plans for U.S. assistance in this field.

More than a dozen detailed reports on foreign mineral resources and related subjects were prepared for publication during the year.

Administration

Many aspects of the Bureau's administrative management were studied during the year. The National Academy of Sciences was asked to study the physical-facility requirements of the Bureau's metallurgical research program. The Bureau itself began a long-range study to define its future role in conserving and developing mineral and fuel resources and in maintaining the health and safety of mineral-industry workers. Other studies concerned themselves with the publication and use of mineral-production data, with new programming processes created by a change in the Bureau's budget structure, and with better ways of selecting among various proposals those most helpful in achieving program objectives. An earlier study designed to improve the quality of the Bureau's technical writing was implemented when the first Annual Publication Citation of the Bureau was awarded to the San Francisco Petroleum Research Laboratory for the best-written manuscript published in calendar year 1961.

Over 200 Cooperative Agreements in Effect

More than 200 "cooperative agreements" were in effect during fiscal 1962. Under the terms of these agreements, certain Bureau research projects were partly or wholly paid for by funds not appropriated to the Bureau by Congress. Over half of the agreements were with private industry, State and local governments, colleges, universities, and nonprofit groups. The remainder were with various agencies of the Federal Government. The accompanying chart shows the amounts made available for expenditure by the Bureau during the last 3 fiscal years.

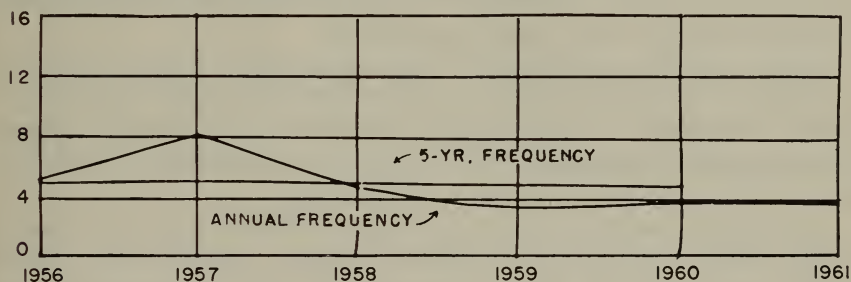
Inventors Granted 16 U.S. Patents

Bureau scientists and engineers reported 12 new inventions, filed 14 patent applications, and were granted a total of 16 U.S. patents during the year. These patents were all automatically assigned to the Department of the Interior and are available for use without royalty payment by any citizen of the United States. The most licenses granted under any one Bureau patent in fiscal 1962 were for the use of a method of tracing the flow of liquids underground by the "postradio-activation" of tracer substances.

The Bureau continued effective space-utilization practices, disposing of inactive or duplicate records and reducing the volume of classified records in headquarters offices. Increased cooperation with the General Services Administration (GSA) accelerated transfer of records from Bureau office and file rooms to Federal records centers and improved the quality of reference service from the centers to the Bureau. Efforts were launched, in cooperation with GSA, to analyze file classification needs and to improve the Bureau's unified filing system.

Employee Health and Safety

For the past 3 years, the frequency of injuries among Bureau of Mines employees has been maintained at 4.0 (or fewer) injuries for each million man-hours of work—see graph below:

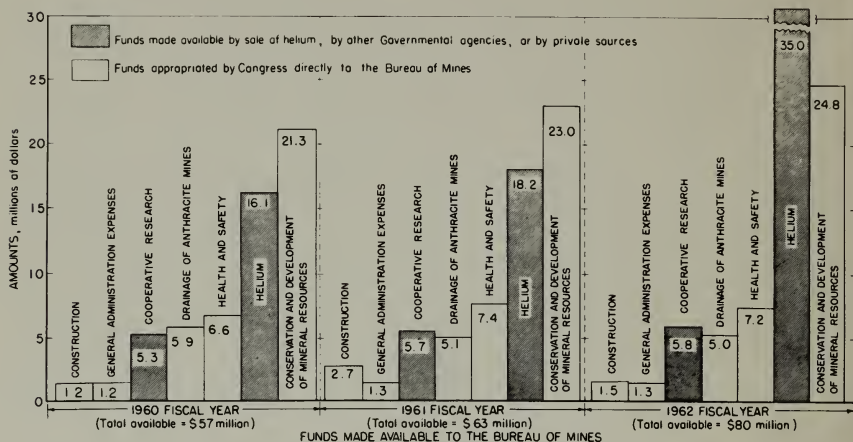


Bureau of Mines disabling injury record

The total amount of all funds made available to the Bureau of Mines in a given fiscal year is more meaningful than the amount expended in a year. Contracts are not signed until money is available, by appropriation or otherwise. A Bureau contract to build a pilot plant, for example, might have been awarded in fiscal 1960 but the last payment might not be made until the structure was finally accepted in 1962, after it had been in daily use for several months.

The following graph shows the money available to the Bureau of Mines in each of the last 3 fiscal years by source and by major object.

The "helium," "cooperative research," and "anthracite mine drainage" columns include balances of unexpended funds carried over from previous years.



Public Reports

Bureau researchers wrote 818 manuscripts for publication, exceeding all previous records. Of these 317 were articles for technical societies, scientific journals, and similar organizations.

Bureau reports published by the Department during the year included 211 describing fundamental research; 68 describing developments of interest to industry; and 8 detailed summations of major Bureau research programs. The 3-volume 1960 Minerals Yearbook, issued during the year, contained 145 chapters.

A procedure instituted for simultaneous technical review of manuscripts speeded publication of Bureau reports. Issuance of a "Style Guide for Bureau of Mines Manuscripts" was a significant step toward helping authors improve manuscript quality. Among other aids incorporated in this guide is a list of standard abbreviations, compiled after an exhaustive study of forms used by national and international organizations in abbreviating scientific and technical terms.

Million Saw Bureau Films

Industry-sponsored Bureau films were shown during the year on educational television channels and in public service broadcasts on regular channels. For the first time, groups of related films were

made generally available to television stations for programing on a regular series basis. These informational films in sound and color, loaned free on request to educational institutions and other organizations throughout the Nation, were shown more than 193,000 times to audiences totaling nearly 10 million. The Bureau circulated approximately 5,000 prints of films averaging about half an hour in length and covering 55 subjects. Each of these productions helped tell the story of the Nation's mineral resources and their use.

"Copper, The Oldest Modern Metal," the latest motion picture added to the Bureau's extensive film library, was selected as a Government entry in the documentary classification in film festivals abroad; other productions were selected for showing at other fairs and expositions, including the Seattle World's Fair. New Bureau motion pictures in production as the year ended dealt with helium, bituminous coal, potash, synthetic rubber, phosphorous, and the natural resources of the State of Washington.

Office of Oil and Gas

Jerome J. O'Brien, *Director*

The Office of Oil and Gas of the Department of the Interior provides advice and technical assistance in the development and coordination of Federal programs, both domestic and foreign, concerned with U.S. petroleum and gas resources and their efficient use. In performing its functions, the Office is the focal point of information for the Congress, Government agencies, and the public, and serves as an important channel of communication between Government and the petroleum and gas industries.

Strategic and Foreign Policy Papers

A compendium of papers on strategic and foreign policy considerations of oil, prepared by the Office, was presented by the Assistant Secretary, Mineral Resources, to the Interdepartmental Committee of Under Secretaries on Foreign Economic Policy. The petroleum outlook was summarized, and topics covered included petroleum refining capacity of the free world, statistics relating to free-world petroleum supply and demand for 1960 and projected to 1965.

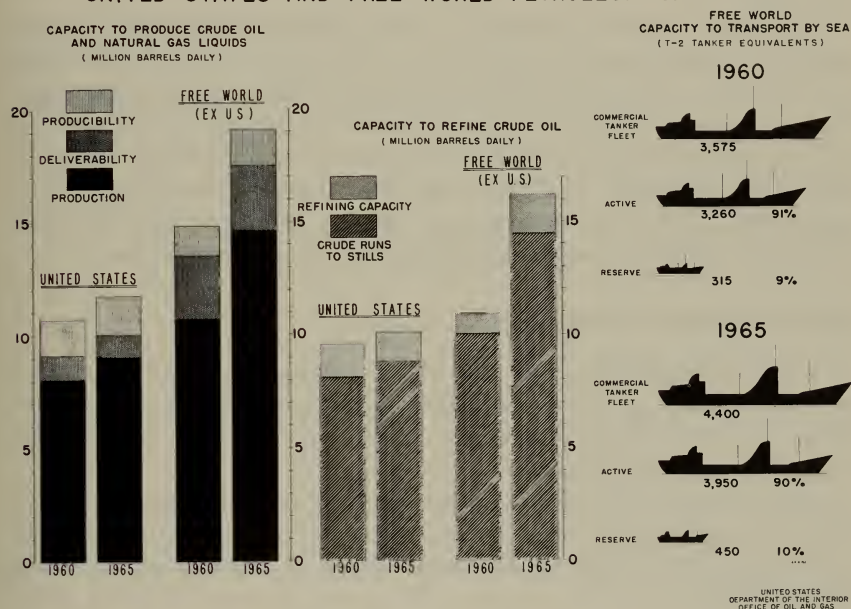
Voluntary Agreement

Worldwide petroleum operations outside the United States have a significant influence upon operations of the U.S. petroleum industry and our Nation's defense and security programs. In view of this, the Voluntary Agreement Relating to Foreign Petroleum Supply was amended October 24, 1961, to permit establishment of a special subcommittee to meet the continuing need of U.S. defense agencies for information on petroleum requirement potentials of specific national security programs, and for technical assistance in evaluating

petroleum resources available to support such plans and programs in future emergencies.

Upon recommendation of the Office, the Petroleum Security Subcommittee was appointed during the fiscal year by the Assistant Secretary Mineral Resources, as administrator of the agreement. The subcommittee is assisting the Office of Oil and Gas in preparing a comprehensive classified petroleum preparedness study using assumptions outlined by the Department of Defense. The Military Petroleum Advisory Board, which formerly carried out defense assignments of this character, has now been terminated.

UNITED STATES AND FREE WORLD PETROLEUM CAPACITIES



International Activities

The Director of the Office of Oil and Gas was chairman of the U.S. Delegation to the eighth session of the Committee on Gas of the Economic Commission for Europe (United Nations), Geneva, Switzerland. The Office was also concerned with other energy matters in the ECE and took part in the formulation of the U.S. position.

This Office was represented on the U.S. delegation to the NATO Petroleum Planning Committee in Paris. The Office has been responsible for drafting papers germane to formulation of U.S. petroleum policy in relation to NATO planning and has participated in all phases of Federal petroleum planning in this field.

Similar responsibilities were discharged for the U.S. delegation to meetings of the Oil Committee of the Organization for Economic Cooperation and Development (OECD).

Extensive information appraising the competitive position of Canadian oil exports into this country was developed by the Office as background for bilateral discussions between U.S. and Canadian Government representatives.

National Petroleum Council Activities

The petroleum and gas industries are called upon by the Government for advice and facts on current trends in the petroleum and gas industries.

This work is carried on chiefly by the National Petroleum Council, which has in preparation reports on: (a) The effects on the free world of the exports of petroleum from the Soviet Bloc; (b) Capacities and precise locations of crude oil and petroleum products pipelines and gas transmission lines and their pumping or compressor stations, as well as an inventory of inland waterway barges, tank trucks, and tank cars; and (c) The productive capacity of petrochemicals made in plants owned or operated by petroleum and gas companies.

Civil Defense Planning

As a continuing function, the Office carries on oil and gas civil defense planning for the United States and is establishing an executive reserve unit of selected personnel whose services will be available during any national emergency.

Guidance was given to State and industry personnel for their civil defense planning, and regional mobilization representatives carried out assignments in five of the eight Office of Emergency Planning regional areas.

State, Industry and Public Activities

The Director represented the Department at the June 1962 meeting of the Interstate Oil Compact Commission, as well as by direct staff contact with officials of the States' regulatory agencies. The Director also reviewed the interdependence of free world nations on their petroleum supply at several annual meetings of industry groups during the fiscal year.

Many individual requests for information from Members of Congress, congressional committees, the general public, private companies, Federal and State agencies, and petroleum representatives of foreign governments, are answered daily.

Among the tasks performed during the fiscal year were the development of technical studies and reports for the Department of Defense. Basic information, concerned with capabilities of petroleum and gas facilities, availability of petroleum products and gas and estimates of requirements, were compiled for use of the Office of Emergency Planning. The Interagency Petroleum Study Committee on crude oil and residual fuel oil import problems received technical assistance and voluminous data in carrying out its mission. Advice was provided to the Department of Commerce on export controls of oil equipment and petroleum technology.

Office of Minerals Exploration

George Fumich, Jr., *Director*

Public interest in the exploration assistance program conducted by the Office of Minerals Exploration of the Department of the Interior reached a new high in fiscal 1962 with 121 applications received and 20 new contracts executed authorizing \$1,452,650 in exploration work. This increased interest is largely attributable to the addition of six mineral commodities, including gold, silver, and iron ore, to the list of commodities eligible for exploration assistance, by amending the OME regulations on July 27, 1961 (26 F.R. 6714). Other sections of the regulations were changed at the same time to simplify filing procedures.

Program Functions

The Office of Minerals Exploration, under Public Law 85-701, conducts a program for the discovery of domestic mineral reserves, excluding organic fuels, by providing financial assistance to private industry on a participating basis.

The OME also administers projects certified as discoveries or developments remaining from the program of the Department's former Defense Minerals Exploration Administration under the Defense Production Act of 1950, as amended.

Under the OME program, financial assistance is available to applicants who normally would not undertake the exploration at their sole expense under current conditions or circumstances and who are unable to obtain the funds needed for the exploration work from commercial sources on reasonable terms.

The OME enters into contracts with qualified applicants to explore for one or more of the mineral commodities listed in the OME regulations. Under these contracts the Government will pay one-half the approved cost of the exploration work but not in excess of \$250,000 on any single contract.

Funds contributed by the Government are repaid by a 5 percent royalty on any production during the progress of the exploration work; and if the Secretary certifies that production may be possible as a result of the exploration, the royalty obligation continues until the Government's contribution is repaid with interest, or for the 10-year period usually specified in the contract. The royalty payment applies to both principal and interest, but it never exceeds 5 percent. The contractor is not obligated to produce, nor is the Government obligated to purchase any production. If nothing is produced, there is no obligation to repay.

Lead and Zinc Stabilization

Under Public Law 87-347, October 3, 1961, the Secretary is authorized and directed to establish and maintain a program of stabilization payments to small domestic producers of lead and zinc ores and concentrates. Responsibility for initiating this program was assigned to the OME.

The authority for operating this program was delegated by the Secretary to the Administrator of the General Services Administration on April 19, 1962, but the Secretary retained the budgetary and reporting functions.

The regulations for the program were agreed to by the Secretary and the Administrator on April 26, 1962. These regulations were published in the Federal Register early in the fiscal year 1963 when funds for the program were appropriated.

OME Operations

During fiscal 1962, 121 applications requesting financial assistance in exploration estimated to cost a total of \$12,785,000, were received. This brings the total to date for the OME program to 260 applications for exploration estimated to cost in excess of \$22,505,000. These applications requested assistance to explore for 28 mineral commodities in 26 states. Actions taken on them are shown in the following table:

Disposition of OME applications

Action	Number	
	Fiscal year 1962	Total for program
Received.....	121	260
Denied.....	41	98
Withdrawn.....	41	67
Contracts executed.....	20	51
Pending on June 30, 1962.....	44	-----

The 20 OME contracts executed during fiscal 1962 brought the total executed to date to 51. A total of 24 contract amendments also were executed in fiscal 1962 and 6 contracts were terminated or canceled, bringing the totals to date to 63 and 21, respectively. Two certifications of possible production under the OME program were issued in this fiscal year. Royalties on production totaling \$9,492 have been received during this same period, increasing royalties received to \$13,942. Contract actions are shown in the following tabulation:

Summary of OME contract data

Contracts	Fiscal 1962			Program through June 30, 1962				
	Number	Total cost	Government participation	Number	Total cost	Government participation		
						Approved	Spent	Repaid
Executed as amended.....	20	\$1,452,650	\$726,325	51	\$2,803,086	\$1,401,543	\$406,119	\$13,942
Certified as possible production.....	2	47,300	23,650	2	47,300	23,650	16,381	10
Terminated, not certified.....	4	115,790	57,895	16	417,880	208,940	89,966	67
Canceled.....	2	110,280	55,140	5	199,110	99,555	-----	-----
In force as of June 30, 1962.....	-----	-----	-----	28	2,138,796	1,069,398	299,772	13,865

DMEA Operations

The last three projects operating under DMEA contracts were certified as discoveries or developments during fiscal 1962, bringing the total number of certified projects to 399. The recoverable mineral commodities found on these 399 projects are estimated to have a value of approximately \$1 billion at current market prices. During this fiscal year, royalties totalling \$369,524 were received from DMEA projects, bringing the total royalties received to date under this program to \$4,323,610. Seventy-one projects have repaid in full the \$2,158,619 contributed by the Government. Actions on DMEA contracts are shown below.

Summary of DMEA contract data

Contracts	Fiscal 1962			Program through June 30, 1962				
	Number	Total cost	Government participation	Number	Total cost	Government participation		
						Approved	Spent	Repaid
Executed as amended.....	-----	-----	-----	1,159	\$56,770,493	\$34,805,244	\$23,347,872	\$4,323,610
Certified as discoveries.....	3	\$793,030	\$396,515	399	30,347,376	18,634,520	14,943,086	4,148,029
Terminated, not certified.....	-----	-----	-----	677	24,177,658	14,802,234	8,404,786	175,581
Cancelled.....	-----	-----	-----	83	2,245,459	1,368,490	-----	-----

Office of Minerals Mobilization

William E. S. Flory, *Director*

The Office of Minerals Mobilization operates under the supervision of the Assistant Secretary, Mineral Resources, and has the responsibility for planning and programing to provide an adequate supply of metals, minerals and solid fuels to meet both the civilian and military requirements under partial and full mobilization, and for Departmental nonmobilization activities and programs in metals, minerals and solid fuels as assigned by the Assistant Secretary.

Shortly after the end of the fiscal year, the Office was renamed The Office of Minerals and Solid Fuels and was given additional responsibilities and functions.

The Office also represents the Department on the Interdepartmental Materials Advisory Committee on stockpiling matters, on the Supplemental Stockpile Advisory Committee for Barter on acquisitions of materials by barter, and on the Interdepartmental Committee on the Soft Coal Industry, and performs the staff work for the Department on metals and minerals export control matters for the Operating Committee of the Advisory Committee on Export Policy.

During fiscal 1962, the Office kept under constant surveillance the supply of metals, minerals and solid fuels from all sources and their availability under any emergency condition. A close watch is continually maintained of industry and market developments that might significantly affect the estimates of supply under mobilization conditions.

In June 1962, agreement was reached between the Secretary of Commerce and the Secretary of the Interior on the stages of minerals processing and types of minerals facilities to which their respective emergency preparedness and mobilization responsibilities pertain.

Mobilization base studies were completed on iron ore and mercury. Other comprehensive studies included a report on the status of the Arizona asbestos procurement program, forecast of production of Jamaican bauxite, review of the domestic beryl purchase program, review of lead and zinc stocks, results of the enactment of the Mexican mining law, review of the Mexican lead-zinc industry, free-world tin position for 1961-62, and a tin price study. Staff analyses were made on the state of the domestic mining industry for chrome, fluorspar, manganese, molybdenum and tungsten. Two revised evaluations were made of high-temperature and special-property materials. Industry Evaluation Board analyses were completed on manganese and sulphur.

Defense Preparedness

During the period under review members of the OMM staff participated in a series of Regional Emergency Planning Conferences held in each of the eight OEP Regions to explain the Comprehensive Program for Survival of Government and Management of Resources developed by OEP. OMM staff developed specific information for inclusion in a planning guide for the emergency management of the survival items for which this office is responsible. The Office also revised the form used for executing memoranda of agreement with the States regarding the operation of the emergency solid fuels plan to conform with the new OEP concept for the emergency management of resources at the State and local level.

The OMM continued to assist OEP in the national resources evaluation program by assembling, coding and maintaining current input data on metals, minerals and solid fuels for use in computing machines for assessing surviving resources and industrial facilities in the event of an enemy attack.

The recruitment of industry officials to serve in the OMM unit of the National Executive Reserve was accelerated during the fiscal year.

Stockpiling

The OMM actively participated in the review of the principles and policies of the stockpiling program, requested by the President early in 1962.

The Office continued to advise OEP on the stockpiling of strategic and critical materials and on disposals of surplus Government inventories.

Office of Geography

Meredith F. Burrill, *Director*



The Office of Geography provides research and other staff services for the interdepartmental Board on Geographic Names and the Secretary of the Interior in the field of foreign geographic nomenclature.

In 1962 the Office placed major emphasis on the revision and enlargement of gazetteers and name files, on the improvement of systems for deriving names from non-roman-alphabet writing systems, and on extension of international cooperation in geographic name standardization. More than 280,000 names were processed according to approved policies for standardization by the Board for Venezuela, Iceland, Southern Vietnam, Gabon, Cameroon, the Republic of Congo, the Central African Republic, Chad, Spanish Guinea, São Tomé e Príncipe, Finland, Austria, Pakistan, and the Sudan. The romanization of Greek, Amharic, Hebrew, Burmese, Cambodian, and Siamese received special attention. A joint name-standardization project was initiated with Kenya, and research on Antarctic names was intensified under a new project.

The identity and classification of named features continued to be a matter of primary interest.

Board on Geographic Names

Edward P. Cliff, *Chairman*

Meredith F. Burrill, *Executive Secretary*

The interdepartmental Board on Geographic Names was established in 1947 to provide a central authority for standardizing geographic

names for use by the Federal Government. It is composed of representatives of the Departments of the Interior, State, Army, Navy, Post Office, Agriculture, Commerce, and Air Force; the Government Printing Office, the Library of Congress, and the Central Intelligence Agency. The Secretary of the Interior acts conjointly with the Board in achieving name standardization and provides staff facilities and maintains the records of the Board and its Committees. Foreign names staff functions are performed by the Office of Geography, domestic names functions by the Geological Survey.

In 1962 the Board and its standing committees took appropriate actions to establish or modify nomenclature policies and to standardize the foreign and domestic geographic names required by the Federal Government. Through its staffs it maintained inquiries services providing official names and names information also to the general public. The Board's Advisory Committees on Antarctic Names and on Arabic and Persian continued active in their fields of special interest.

Office of Coal Research

George A. Lamb, *Director*

The Office of Coal Research, created in 1960 by Public Law 599 of the 86th Congress, is now executing and administering a forward-looking research and development program following the guidelines laid down by the Congress. As defined by the statute itself, research means scientific, technologic, and economic research, and the practical application of that research as well.

By the end of fiscal year 1962 the Office's first contract, a study to determine the potentialities for sizeable new uses of coal, had been completed, and seven additional contracts obligating all funds appropriated are currently in effect.

Function of OCR

The functions of the Office of Coal Research as stated in Public Law 599 are to—

(1) develop through research, new and more efficient methods of mining, preparing, and utilizing coal;

(2) contract for, sponsor, cosponsor, and promote the coordination of, research with recognized interested groups, including but not limited to, coal trade associations, coal research associations, educational institutions, and agencies of States and political subdivisions of States;

(3) establish technical advisory committees composed of recognized experts in various aspects of coal research to assist in the examination and evaluation of research progress and of all research proposals and contracts and to insure the avoidance of duplication of research; and

(4) cooperate to the fullest extent possible with other departments, agencies, and independent establishments of the Federal Government and with State governments, and with all other interested agencies, governmental and nongovernmental.

The mission of OCR is to exploit the full potentiality and versatility of this abundant energy and chemical resource to the maximum

welfare of the United States. The Office of Coal Research is devoting its efforts to enlarge and increase the use of coal within presently known fields of utilization and in addition to seek new uses for which coal is economically and technologically suited.

The establishment of the Office of Coal Research as a separate agency within the Department of the Interior permits full development and maximum control of a research program designed for expeditious commercial results—at the same time avoiding conflict with the programs of the Bureau of Mines and assuring the coordination of the two research efforts.

Industry-Government Cooperation

The Secretary of the Interior has a General Technical Advisory Committee of 20 members to advise him and the Office of Coal Research on the development and direction of the program. Committee representation includes leaders among the coal producers, railroads, electric utilities, educational institutions, labor, and manufacturers of equipment.

One meeting of the full committee was held in fiscal 1962. In addition, other meetings and conferences were held with individual members or segments of the GTAC for the purpose of judging the technical and economic merits of research proposals and to aid OCR in assessing and acting upon specific problems.

1962 Contract-Research Program

The seven contracts executed during fiscal 1962, all in progress at the end of the year, are briefly described in the following listing alphabetically arranged by name of the contractor.

Bituminous Coal Research, Inc.

This contract has as its objective the development of processes and methods to prepare, transport, and use pulverized ultrafine coal falling in the range of 5 to 74 microns. If successful, this development will create an entirely new commodity since finely ground solids exhibit many properties normally associated with fluids. Such materials can be pumped and handled like fluids in simple items of equipment.

The ease and convenience of handling can introduce coal in many markets which are currently not available to it. Likewise, finely ground coal can be used in many processes and areas of interest such as gasification, liquefaction, and chemical manufacturing in their

various forms. An additional potential exists in removal of undesirable impurities from coal such as ash and sulphur. Successful development of this potential may well have a significant effect on coal preparation plant practice and air pollution control by coal users.

FMC Corporation

The contractor will conduct both bench and pilot plant scale experiments to determine the technical feasibility of extracting from coal a crude oil suitable as a diluent for a refinery feed stock. The contractor will also conduct experimental work on a multiple fluid bed and a high-temperature pyrolysis process, or a combination, to produce a pumpable synthetic crude oil which can be used to transport the remaining fuel constituents (char) of the coal to a market located some distance away. The contractor's effort will utilize processes which have not been previously investigated. The project has the primary objective of maximizing the fluid oil yields and a yield of up to 80 gallons per ton of coal is believed an attainable goal.

General Electric Company

This project includes bench scale experimentation and process development work to determine the feasibility of up-grading coal by reacting it with hydrogen. The hydrogen will be subjected to electrical discharge to increase its reactivity and simplify the process of introducing additional hydrogen into the chemical compounds which constitute coal. A new and unique process which appears to have great economic and technical promise for the production of chemicals and synthetic fuels is being studied.

Georgia Institute of Technology

This project is concerned with a determination of the compounds which may result by reactions of coal or coal compounds with various other materials in a plasma jet. Plasmas of various gases will be considered and reactants, such as hydrogen; ammonia; halogens; etc., will be introduced and the resulting products will be analyzed.

The Ralph M. Parsons Company

This contract is concerned with an accelerated pilot plant development program for a process utilizing new process methods and a new catalyst for manufacturing gasoline and related chemicals and char from high-volatile bituminous coal. The work will include a detailed feasibility study followed by a pilot plant design, construction, and operation program to determine overall process technology, and

economics. This pilot plant is to be along a process line that is different from past approaches. Details on the confidential aspects of the new processes will be available if feasibility is favorably determined.

Pope, Evans & Robbins

This is a contract for the development and design of a totally new, completely integrated, coal-fired industrial heating plant of an intermediate-size range (10,000 to 60,000 pounds of steam per hour).

Numerous new concepts for coal handling, combustion, ash and fly ash collection will be developed and evaluated. Prototype components of the package unit will be constructed and tested prior to the development of the complete final design of the overall system. All elements of the system will be so integrated and refined as to produce a compact, safe, automated and efficient installation designed to prove economically attractive to the owners of industrial establishments.

Virginia Polytechnic Institute

The contractor will develop scientific engineering methods for determining the most favorable combination of the various elements of mining which can be controlled by the mine operator. By applying the scientific methods and formulae developed under this contract, a coal operator will be able to modify his system of mining and use of operating supplies to insure lowest cost production under the physical conditions existing in his underground coal-producing sections or face areas. VPI will conduct mining engineering, industrial engineering, and operations research to develop mathematical models, formulae, and programs which can be quickly solved by computer techniques, and will make them available on a nonprofit basis to any interested party having a legitimate business or academic interest.

Completed Contracts

The first contract of OCR was awarded to Booz-Allen and Hamilton and was completed in the spring of 1962. It provided for a comprehensive study of the market potential for coal. Entitled "Survey of Opportunities To Stimulate Coal Utilization," two volumes, it was printed and is distributed through the Office of Technical Services, U.S. Department of Commerce.

For fiscal 1962, the Office of Coal Research operated on a total budget of \$1,940,000, including \$1,000,000 appropriated by the Congress and a carryover of \$940,000 from the previous year when organization of the Office was still in progress.

Oil Import Administration

J. Cordell Moore, *Administrator*

The Secretary of the Interior, pursuant to Presidential Proclamation 3279, dated March 10, 1959, established the Oil Import Administration within the Department and issued regulations for the operation of an oil import program.

The objective of the oil import program is to insure a stable, healthy petroleum industry within the United States capable of exploring for and developing new domestic petroleum reserves.

In administering the program, the Oil Import Administration:

1. Analyzes data prepared by the Department's Bureau of Mines relating to petroleum demand in the United States, by commodity type and petroleum districts, in order to set the overall amounts of crude and unfinished oil, and finished petroleum products to be allowed into the United States and Puerto Rico.
2. Establishes equitable semiannual oil import allocations for individual eligible oil importers by product type and district, other than residual fuel oil (which is on an annual basis), and issues import licenses.
3. Maintains continuous evaluation of the methods for establishing oil import levels, individual import allocations and programs for exchanging foreign oils for domestic oils and initiates positive action for correcting apparent deficiencies, prepares and compiles necessary backup data for justifications and submits recommendations for changes.
4. Analyzes monthly reports from each importer showing the amount and disposition of petroleum imports entering the Nation under license and issues public reports concerning the oil import situation and the administration of the program.

5. Analyzes all exchange agreements of foreign crude and unfinished oils and domestic crude and unfinished oils.

6. Issues letter authorization to Collector of Customs to permit entries without an import license of small quantities of crude oil, unfinished or finished products.

7. Attends hearings which are conducted by the Oil Import Appeals Board to consider petitions submitted by established and would-be importers for modifications or grants of allocations and submits such written comments as are deemed appropriate and beneficial in each case.

8. Responds to an increasing volume of requests for information concerning the administration of the program from Congress, the press, foreign governments, other governmental agencies, and the public.

Summary of Activities

During fiscal 1962, the Oil Import Administration issued 2,175 licenses for importation of crude petroleum and its derivatives to eligible importers according to commodity type.

Prior to the close of the fiscal year, the Administrator announced overall oil import levels for the allocation period July 1, 1962 through December 31, 1962, and issued individual oil import allocations to 192 eligible importers, for crude oil and finished products other than residual fuel oil to be used as fuel. For the allocation period April 1, 1962 through March 31, 1963, individual import allocations were issued to 45 eligible importers of residual fuel oil to be used as fuel.

Prepared and promulgated 3 amendments to the oil import regulations, making changes within the broad policy of the existing Presidential proclamation which involved adjustments in the method of allocating crude oil, unfinished oils and residual fuel oil to be used as fuel.

Received and processed over 6,000 reports from importing firms submitted in compliance with section 18 of the oil import regulations. Extracted and tabulated oil import data from these reports for statistical and administration purposes. Prepared 20 detailed documents, which were released to the public, showing oil import facts on an individual company basis by importing areas and including refinery and terminal "inputs" of crude oil and residual fuel oil respectively. Prepared and released semiannual bulletins on total oil imports listing the country of origin of all imports and the percentage ratio each exporting country shares in the U.S. oil import market.

Received, analyzed and recorded 525 "exchange agreements" covering planned action by authorized crude oil importers to exchange foreign oil for domestic oil for processing in their own refineries. This

type of exchange is permitted under the oil import program subject to restrictions and provisions set forth in the oil import regulations. Analyses of these exchange agreements are necessary to assure regulation compliance.

Pursuant to section 8 of the oil import regulations, prepared and forwarded 133 letters of authorization to Collectors of Customs granting approval for small quantities of foreign oil to be entered without an import license. Authorization requests are received covering individual cases and are evaluated and acted upon on the basis of facts presented in each case.

Pursuant to an invitation extended by the Chairman of the Oil Import Appeals Board, dated April 10, 1962, the Oil Import Administration submitted detailed written comments to the Board on petitions for modifications of allocations which the Board has entertained.

Office of the Administrative Assistant Secretary

D. Otis Beasley, *Administrative Assistant Secretary*

The Administrative Assistant Secretary in discharging the duties of the Secretary for administrative management directs and supervises seven staff divisions: administrative services; budget and finance; inspection; management research; personnel management; property management; and security.

Administrative Services

The Division of Administrative Services furnishes staff guidance for all administrative services programs and activities of the Department, and operates these services for all units of the Department in the Washington metropolitan area. Workload in all operations increased sharply during the year with the normal growth of regular programs and the establishment of the Bureau of Outdoor Recreation.

Events deserving of particular mention were (1) expansion of Department central library services to field employees and offices and increased use of translated foreign language materials, (2) disposal of 1,600 cubic feet of obsolete records and the resultant release of three rooms of office space for reassignment, (3) increase in use of Department Museum facilities by more than 40 percent, with approximately 100,000 visitors during the year, and the preparation and presentation of a special "true or false" display on the differences between genuine handmade and imitation Indian art work and jewelry, (4) assumption of full accounting and budgeting duties for funds transferred to the

Department for the Area Redevelopment Administration, and preparation of an accounting manual for approval of the General Accounting Office, and (5) development and issuance of the "Employee Information Bulletin" which keeps employees advised of their rights, benefits and privileges, as well as other information requiring distribution to all personnel.

Budget and Finance

The Division of Budget and Finance has primary staff responsibility for the budget and financial activities of the Department. This includes accounting systems, financial policy, internal audit policy, review of internal audit and General Accounting Office audit reports, financial reporting and budgeting. The Division represents the Department in these fields in liaison with the General Accounting Office, Bureau of the Budget, Treasury Department, and other Federal departments and agencies, and appropriation committees of the Congress.

During the past year the Division completed a review of the financing of Water Resources Division, Geological Survey and with staff of the General Accounting Office and Geological Survey, devised a simplified method of financing the Division's operations. Assisted the Bureau of Indian Affairs in simplifying allotment accounting at the agency level.

Assisted power agencies in making modifications in the chart of accounts to comply with FPC revised accounting procedures which were effective July 1, 1961.

During the year, the Division reviewed and appraised the findings and took action as necessary on 68 General Accounting Offices audit reports, 162 internal audit reports rendered by bureaus of the Department, and 30 investigative and inspection reports.

The budget activities for the year included the processing of two regular budgets; one for the Bureau of Reclamation and power marketing agencies, and one for the other bureaus, in addition to supplemental appropriation budgets.

Inspection

The Division of Inspection is responsible for the inspection and investigative activities of the Department. The purpose of the inspection program in the Department is to insure high ethical standards in the management and administration of the Department's affairs.

The inspection effort is directed to assist positive management so that areas of probable employee difficulty may be identified prior to

employee involvement. In this regard, the objective of the inspection program is to develop and maintain at all organizational levels a systematic inspection activity by means of which effective standards of ethical conduct may be promoted.

The Division of Inspection has responsibility for Departmental handling of matters under the President's Equal Employment Opportunity policy, enunciated in Executive Order 10925, dated March 6, 1961. Regulations approved by the President's Committee on Equal Employment Opportunity, placing the Department's program into effect, have been issued to all personnel of the Department; and an equal employment opportunity poster was prepared and is now displayed on the bulletin boards of the operating offices designating Equal Employment Policy Officers.

Management Research

Continuing improvement in the conduct of the operations of the bureaus and offices of the Department and in their management is the primary objective of this division. Projects assigned to its management analysts during the past year attest to the scope of the division's activities.

Examples are: Management analysis and recommendation on the organization of the Department for Emergency Preparedness; survey of program and administrative relationships among the Bureau of Commercial Fisheries central office and its regional offices and their subordinate field installations, including study of the adequacy of the staffing of the regional offices and the Bureau's headquarters research management staff; study and implementation of the organization and management aspects of the establishment of the new Bureau of Outdoor Recreation; review of organization and procedures for contracting for research and development work by the Office of Saline Water; comparative study of bureau employment in the Washington metropolitan area; organization and management study related to the implementation of the Interior-Army agreement in Alaska; study of the correspondence control system of the Department.

The Branch of Incentive Awards provided assistance to the bureaus and offices in their suggestions, work accomplishment, and other incentive awards activities. There has been a slight downward trend in the number of suggestions received; however, increases have been noted in the average dollar amount of awards given and the number of superior performance and special acts or services awards granted.

For the seventh consecutive year the Department of the Interior Incentive Awards Program evidenced quality suggestions from its employees by adoption of 33 percent of the total number of suggestions

received. The average adoption rate over the past seven years was 34.5 percent which was much higher than the entire Government average over that period. The average award paid during the 1962 fiscal year for each adopted suggestion also reached a new high, \$44.19. The average award paid for Superior Performance and Special Acts or Services Awards was \$232, an increase of \$24 over the 1961 fiscal year.

The following statistics reflect the 1962 fiscal year activities of the incentive awards program:

Cash awards:		Cash awards:	
Suggestions.....	1168	Valor.....	6
Superior Performance.....	1158	Meritorious Service.....	135
Special Acts or Services.....	158	Commendable Service.....	543
Distinguished Service.....	25		

Personnel Management

The Division of Personnel Management has primary staff responsibility for the development of policies and programs to establish and maintain an adequate qualified and efficient working force in the Department.

Executive Orders 10987 and 10988 were of signal importance to the Department since they had a direct effect on employee management relations, grievances, disciplinary actions and employee appeals. All related policies and procedures previously issued by the Department were reviewed, revised and rewritten to conform with the provisions of the two Executive Orders.

The increased interest in conservation work resulted in the publication of an eleven page booklet entitled "Information on Competitive Sub-professional Employment in Conservation". A concentrated study was conducted of the voluntary resignations and transfers on the part of our permanent work force. Reasons for quitting were analyzed. Percent of quits by age groups and length of Federal service were studied. The resignations were broken down by the main professional groups within the Department and various other related facts were collected.

Data was collected from all bureaus on methods used to overcome the shortage of qualified persons in the field of science and engineering through increasing skills of present employees, thorough utilization of professional skill and the development of new procedure for accomplishing scientific and engineering work without increasing the professional staff.

In line with the President's intent to maintain the Federal career service free from discrimination on the basis of sex, the Department's

personnel practices were reviewed and instructions issued to assure compliance to the policy.

An appraisal of Departmental management training in the Department of the Interior was made during the year. The appraisal was conducted for the first 10 groups of the Junior Management Training Program and for the first 3 groups of the Departmental Manager Development Program.

For the 6th consecutive year since the establishment of a Department safety organization in 1955, the frequency rate of work injuries has decreased. The rate is presently at a new low of 8.4 disabling work injuries for each million man-hours of exposure, contrasted with a rate of 14.3 in 1955.

Property Management

The Division of Property Management has primary staff responsibility for all property management activities of the Department.

Contracting and purchasing activities of the bureaus and offices continued to be directed toward compliance with the Department's policy for advancing economic benefits to labor surplus areas and small business firms. Measures were taken in several areas of activity to effectively promote and implement Executive Order 10925, for the expanded program of employment and advancement without discrimination.

A Memorandum of Understanding was executed with the General Services Administration under which that agency will assume responsibility for conducting sales of most of the surplus personal property generated by bureaus of this Department.

The Department's policies on board of survey action were revised to simplify survey procedures and to reduce the paperwork involved in granting relief from accountability for relatively low cost items. During the year, personal property acquired at a cost of more than \$600,000 and no longer needed in Department programs was donated to public schools and hospitals through the donable property program administered by the Department of Health, Education, and Welfare. To provide more effective and timely controls and prevent accumulation of unnecessary files, emphasis was directed to:

1. Improvement of the reporting system.
2. Realistic review of existing records control schedules and reduction of overly liberal use of "indefinite" and "permanent".
3. Full utilization of available technical services of the National Archives and Records Service.

Security

The Division of Security has primary responsibility for the establishment and maintenance of security throughout the Department. The Division also has the assignments for Departmental direction and coordination of the radiological defense training program and coordination of activities under the Federal Disaster Act of 1950.

The radiological defense capability of the bureaus and offices of the Department has continued to advance at a satisfactory rate with the number of trained instructors and monitors increasing. In addition, the Department has the responsibility for establishing monitoring network under the jurisdiction of the Office of Civil Defense, Department of Defense. These stations serve a dual purpose; they are regular installations of the Department of the Interior, and also serve a part of the Federal network.

Office of the Solicitor

Frank J. Barry, *Solicitor*

The Office of the Solicitor performs all legal work for the entire Department. In addition to the legal work directly concerned with the programs and activities of the Department and its bureaus, the Office of the Solicitor handles matters relating to torts and other claims, inventions by personnel of the Department, and appeals to the Secretary in public land proceedings and Indian probate matters. The Board of Contract Appeals within the Office decides appeals under contracts by the bureaus and offices of the Department.

The number of matters considered in the Office of the Solicitor continued at a high volume with approximately 64,000 hours spent giving oral advice and attending conferences and meetings. Appeals in land cases reached a record high of 651 far surpassing the prior year's record number of 480.

A thorough review was undertaken of the legislative history of the patent provisions of the Saline Water Act of 1962 (Public Law 87-295), the Coal Research Act (Public Law 86-599) and the Helium Act Amendments of 1960 (Public Law 86-777) to determine the intent of Congress as to inventions arising out of Government-financed research and development work. The results of this study were set forth by the Solicitor in his opinion of May 7, 1962 (M-36637) holding that patents arising out of Government-financed research under such acts must be made available without cost to the public.

San Luis Decision

In an opinion of December 26, 1961 (M-36635), the Solicitor held that lands in the State service area of the San Luis Unit, Calif., which will be served through the joint Federal-State facilities, are not sub-

ject to the excess land limitations of Federal reclamation law but lands in the Federal service area are subject to such limitations.

The Solicitor, in an opinion of December 26, 1961 (M-36634), held that early payout of the construction charge obligation does not relieve excess lands of the limitations of Federal reclamation law. Negotiations for repayment contracts on the Kings River and Kern River projects are well advanced.

This Office assisted in the development and execution of the permit program initiated in the summer of 1961 to bring under control the extensive trespasses along the Lower Colorado River. To date the greater portion of the estimated 1,000 trespassers have been placed under permit and are paying full rental value for their occupancy. The balance are in process of negotiation and execution. Full Federal control should be accomplished by December 1962.

On September 27, 1961, the Congress consented to the Delaware River Basin Compact establishing a four-State river basin commission, with full Federal participation, to undertake comprehensive planning and development of the populous Delaware River Basin. The Compact and the commission established thereunder are unique in joint Federal-State relationships. The Solicitor coordinated and represented Federal departments and agencies in working out the provisions of consent legislation to protect all Federal interests, and carry out the objectives of the compact.

In connection with the helium conservation program of the Bureau of Mines, contractual commitments to accept early delivery of crude helium extracted from natural gas at privately owned plants required prompt acquisition of easements for about 400 miles of pipelines in Kansas, Oklahoma, and Texas. Within a period of 6 months, all preliminary legal work necessary for construction operations was finished, including contracts for construction and acquisition by purchase or condemnation of required pipeline rights-of-way.

Court Decisions

On June 28, 1962 the U.S. Court of Appeals for the District of Columbia Circuit in the actions entitled *Udall v. Wisconsin, Colorado and Minnesota* (No. 16,669) and *Udall v. Michigan* (No. 16,670) upheld apportionments by the Secretary of Federal aid funds under section 4 of the Pittman-Robertson Act (16 U.S.C. 669c) on the basis of the number of individuals who bought one or more hunting licenses, contrary to the contention of the States that such apportionment should be on the basis of the number of licenses sold.

The Supreme Court of New Mexico, on June 5, 1962, affirmed the decision of the State District Court that Navajo Indians residing on the portion of their reservation within New Mexico were eligible to

vote in the State's elections. *Montoya v. Bolack*, 372 P. 2d 387. At the outset of this election contest the Secretary of the Interior filed a brief as *amicus curiae* in support of the Indian right to vote. In rejecting the contestant's argument that the Navajos were not New Mexican residents for voting purposes, the Court found that the decision of the United States Supreme Court in *Organized Village of Kake v. Egan*, 369 U.S. 60 (March 5, 1962), went far to clarify and resolve the issues in the voting case.

In *Boesche v. Udall*, No. 16,238 in the U.S. Court of Appeals for the District of Columbia Circuit, the court en banc on June 15, 1962, on rehearing, adopted the judgment of a division of the court, entered on November 16, 1961, sustaining the Secretary's authority to cancel administratively oil and gas leases issued on defective applications. This ruling is in conflict with the ruling of the 10th Circuit in *Pan American Petroleum Corp. v. Pierson*, 284 F. 2d 649.

In *Louise Safarik et al. v. Udall*, No. 16,646 (June 7, 1962), the Court of Appeals for the District of Columbia Circuit sustained the authority of the Secretary, in changing his interpretation of a statute, to give his new interpretation prospective effect only. The decision of the court in effect validated thousands of partial assignments of oil and gas leases approved under the old interpretation.

Contract Appeals

In a case of first impression, *Weldfab Incorporated* (68 I.D. 241), the Board of Contract Appeals held that the revised Changes Clause of Standard Form 32 for supply contracts (October 1957 Edition), permitting equitable adjustment concerning contract work not changed, in addition to work directly changed by a change order, does not apply to the contractor's expenses during a standby period while the contractor is awaiting the issuance of the change order. Such expenses could be recovered only under an appropriate Suspension of Work provision, which was not included in the contract.

The Board of Contract Appeals denied two motions for reconsideration of its decision in *Merritt-Chapman & Scott Corporation* (68 I.D. 1). The Comptroller General furnished an advance decision (B-142040, April 2, 1962) as to propriety of payment of a voucher for increases in labor costs, pursuant to a wage escalation clause in the prime contract for construction of Glen Canyon Dam as to one group of workers (five basic crafts), holding that after careful consideration of the evidence before the Board, there was no adequate basis for questioning the Board's decision. There is pending with the Comptroller General another request for advance decision concerning the payment of increased labor costs of other employees (electricians).

Office of the Legislative Counsel

**Max N. Edwards, *Assistant to the Secretary
and Legislative Counsel***

The volume of work handled by the Legislative Counsel of the Department's Office of the Solicitor is large. During the 87th Congress, the Department was asked by various committees to report on a total of 1,601 bills. Reports were prepared on 1,304—81.44 percent of the total. In addition, the Department initiated and drafted 218 proposed bills for submission to Congress by Executive communication and reviewed and commented upon 72 proposed bills initiated by other departments.

The total number of public laws enacted by the 87th Congress and approved by the President through October 17, 1962, was 838. The Department prepared reports on 290 of them, 34.60 percent of the total.

The total number of bills introduced in the 87th Congress was 17,337. The Department maintained legislative histories on 3,147 of them (18.15 percent), and partial records on an additional 566 (3.26 percent).

The Legislative Counsel's office coordinates the preparation of all legislative materials in the Department, except appropriations, and the testimony of Departmental witnesses before the various Congressional committees. Some of the more important laws enacted by the 87th Congress in the field of natural resources and conservation were laws authorizing the start of three new major reclamation projects (the \$171 million Fryingpan-Arkansas in Colorado and the San Juan Chama and Navajo irrigation projects in New Mexico, with a combined cost of \$220 million); an expanded water desalinization program; laws creating three national seashores for addition to the National Park System (Cape Cod on the Atlantic Coast, Padre Island on the Gulf Coast of Texas, and Point Reyes on the Pacific Coast north of San Francisco); a law authorizing an expanded program of wetlands acquisition which will make possible the establishment of widespread new waterfowl refuges and the acquisition of title to or easements on approximately 2 million acres of land; a law providing effective sanctions for the enforcement of an international tuna conservation program.

In addition to the enacted legislation, a major effort was made on a series of important bills that were considered by the 87th Congress and were the subject of extended debate and discussion, and that will undoubtedly be further considered by the 88th Congress. These included an extensive and farsighted program of outdoor recreation, including new methods of financing; a far-reaching 5-

year conservation plan for the 467 million acres of public lands administered by the Bureau of Land Management; the transportation of coal "slurry" by pipeline; a wilderness bill to preserve in its original status for the benefit of present and future generations some of our dwindling natural resources; a pumped-back storage plan which uses cheap off-peak energy to pump water to high elevations for later release to generate hydroelectricity at hours of peak consumption; the expansion of the Indian credit program to stimulate economic development of the underdeveloped Indian reservation areas; a program to improve public works, health, education, shipping and transportation, and to stimulate self-government in the United States territories of American Samoa, the Virgin Islands, and Guam, and in the Mandated Trust Territory.

Resources Program Staff

Charles H. Stoddard, *Director*

The Resources Program Staff in the Office of the Secretary of the Interior performs two major functions: Central staff and departmental coordination.

As central staff, Resources Program Staff assists and advises the Secretary, Under Secretary, and other secretarial officers in the development and initiation of departmental policy and in the formation of long-range program objectives. It also handles a variety of special assignments. The Staff also carries on a coordinating role for several of the departmental functions which range across the lines of the individual bureau operations and which are coordinated at the departmental level.

This coordinating activity centers around five areas of regular and continuing responsibilities. The Staff works to coordinate the bureaus' activities in these areas along the lines of departmental policy and objectives and to coordinate the Department's operation with that of other Federal agencies. These areas of continuing responsibility and their significant activities during the past fiscal year follow:

Program Planning Coordination

A departmental system of long-range planning and programing was launched in April 1962. The Secretary directed the Staff to assist the Under Secretary in heading this operation by establishing criteria, projections and procedures for cooperative programming with the Bureaus. Preliminary departmental program plans for soil and moisture conservation, forestry, and range conservation have been assembled.

Area Redevelopment Coordination

The Staff has led and correlated the Department's participation in the area redevelopment program in planning for immediate and long-range projects with the bureaus in areas of chronic unemployment or underemployment where water, minerals, forestry, recreation, fish and wildlife play a major role.

International Activities Coordination

The Staff continued its work of coordinating the Department's interests and responsibilities in minerals, fisheries, and other resource product fields as affected by U.S. participation in the General Agreement on Tariffs and Trade (GATT). The Staff provided representation on U.S. delegations to the meetings of the contracting parties of GATT and several of its committees at meetings held in Geneva, Switzerland. The Staff also provided departmental support for the administration's Trade Expansion Act of 1962.

Field Committee Coordination

The Staff coordinates the Department's regional field activities through its six field committees whose chairmen are members of the staff. The field committees function to coordinate bureau programs within their regions, reconcile overlapping and conflicting problems, identify and develop project and program plans and provide liaison with other Federal departments on interagency committees.

Resource Economics

The Staff economist develops long-range resource projections for program planning, carries out special economic studies (credit, public works, etc.), inventories current resource statistics and acts to correlate current resource economics research.

Special Major Assignments

Additional major Staff functions included interagency leadership on river basin planning in the development of new policies, standards, and procedures for the formulation, evaluation and review of plans for Federal water and related land resource projects. New standards were approved by the President on May 15, 1962, and then became effective for use by the four departments and the Bureau of the Budget. In addition, the Staff provided services with respect to negotiations with the States involved in the legislation granting Federal consent to the Delaware River Basin Compact.

The Staff assisted the Secretary in development of a comprehensive Federal outdoor recreation program, which resulted in the establishment of the Department's Bureau of Outdoor Recreation, proposed legislation for Federal grants to stimulate recreation planning by the States, and financing for Federal acquisition of recreational lands through a Land Conservation Fund. Overall leadership was given the Staff in planning and programing the White House Conference on Conservation in May.

Office of the Science Adviser

Roger Revelle, *Science Adviser*

The role of science in policy matters of the Department has received continued attention from the Science Adviser since establishment of this departmental post early in year 1962. In this, the Science Adviser has served as a consultant to the Secretary, Under Secretary, and Assistant Secretaries on the Department's natural-resource research programs. He has studied particularly needs for new research to meet changing national and world conditions. This recognizes the importance of science and technology in present day world affairs.

The great need for increased water resources and problems resulting from irrigation of arid lands have been dominant both nationally and internationally. In this regard, the Science Adviser served as the chairman and scientific leader on a White House-Interior Panel which studied waterlogging and high salinity which are spoiling agricultural lands in West Pakistan. On another scene, but closely related to this problem, was consultation on increased salinity of Colorado River drainage into Mexicali Valley, Mexico.

Coordination of science throughout Government has been enhanced by increased activities of the Federal Council for Science and Technology. The Science Adviser has represented the Department on the Federal Council and has served as chairman of the Council's Committee on Natural Resources. This committee has carried out extensive studies on biological, energy, land, mineral, and water resources.

Scientific matters which concern several bureaus of the Department are represented by the Science Adviser where cooperation is needed with other agencies within and outside the Government. Examples of these activities are the U.S.-Japan Committee on Scientific Coopera-

tion, Advisory Committee to the Department of State on Antarctic Affairs, cooperation with the National Science Foundation on research programs of the Organization for Economic Cooperation and Development, and numerous tasks with the Agency for International Development.

Practical applications of solar energy have been studied in cooperation with the National Academy of Sciences-National Research Council. A first study has shown that solar energy could be beneficial to arid regions and to lesser developed areas as a source of power for small refrigeration units and for electrical generating plants. Development of solar energy will be a subject of future consideration by the Science Adviser for the Department.

In summary, the Science Adviser has had as a special goal the proper balance and growth of research programs of the Department to implement recommendations of the President's special message on natural resources. This has been done with the realization that an investment in research today to develop and protect natural resources will pay generous dividends in future years.

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